THE MODEL ENGINEER

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THE
MODEL ENGINEER

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Our Cover Picture

Model car racing has made great strides since the war, in respect both of performance and popularity, but development in this branch of model engineering has not been confined entirely to the pursuit of sheer speed. While round-the-pole racing is still popular, and some remarkable speeds have been attained in all classes, many enthusiasts have sought to capture the realism of the full-size race track, in which cars can race against each other instead of merely against the clock. This has been made possible by the use of guided cars on multi-lane tracks, and though the speeds achieved in this way are far below those reached on circular tracks, they are certainly by no means inferior in popular appeal, spectacle or thrills. Our photograph shows the pits section of the racing track at last year's " M.E." Exhibition, with teams of true-to-scale racing cars in national colours, pit attendants and spectators, reminiscent of an up-to-date Lilliput, with Gulliver looking on, in the person of Mr. Raymond Fallick, who ably assisted Mr. Rex Hays in the running and management of the track.

SMOKE RINGS

Our Oldest Subscriber ?

WE HEAR occasionally from readers of long standing, some of them even claiming to have taken THE MODEL ENGINEER from our first issue in 1898, or to have carried on a legacy of readership from that date. But very few readers can claim to have been regular *subscribers* for anything like such a long period, and we were, therefore, interested to hear from Mr. Bertram R. White, of New York, that he first subscribed to THE MODEL ENGINEER in January, 1899, and although he subsequently found it more convenient, for some time, to obtain the bound volumes as they were issued, he again became a subscriber, and remains so up to the present date. He has also read Volume I of THE MODEL ENGINEER in the New York Public Library, and can, therefore, claim to be a reader from the first issue. Mr. White has been active in many branches of model engineering, including " O " gauge railways, steam and petrol engines, and has recently fitted up a basement workshop in his house at Flushing, N.Y., where he proposes shortly to install a Myford M.L.7 lathe, having been much impressed by the work done on this type of lathe by British workers. We wish him every success, and many more years to add to his record of readership of the " M.E."

A Model Railway for Enginemen

THE NORWICH Mutual Improvement Class for British Railways footplate staff has recently installed in its instruction coach a working model railway donated by Trix Ltd.

The layout is fully signalled and has over 100 ft. of track arranged in a specially designed formation so that enginemen themselves can enact in miniature, the correct running of trains. Many of the circumstances described in the Railway Rule Book can be demonstrated, notably Rule 55 which concerns the protection of a train brought to a stand at a signal, Rule 183 where the assistance of a locomotive is required due to an engine failure on a running line, and Rule 180 which concerns warning of obstructions to approaching trains.

Many other instructional devices are housed in the coach. These include a complete installation of the Westinghouse and vacuum brake systems, a locomotive injector, a mechanical lubricator and sectional working parts of typical valve gears for two- and three-cylinder engines.

The Mutual Improvement classes are held at a large number of motive power depots throughout the country. The Railway Executive provides such facilities as accommodation, literature and films, but apart from this assistance the classes are voluntary and are kept going by subscriptions from the members. It is good to see such keen enthusiasm amongst our railwaymen.

News from New Zealand

WE HAVE received a long and newsy letter from Mr. L. G. Callis, formerly of Ruislip, who emigrated to New Zealand some three years ago, and is now at Maeroa, Hamilton. He gives us encouraging reports of model engineering activity in this locality, including a successful model exhibition held in the Hamilton Art Gallery, at which a wide variety of models was exhibited, including several model power boats, the popularity of which is on the increase. Mr. Callis has also made the acquaintance of Messrs. Watters, Macdonald and Tetley, of the Auckland Model Engineering Society, who are keen model power boat enthusiasts, and witnessed demonstrations of two of Mr. Tetley's hydroplanes, powered by 10 c.c. and 15 c.c. engines respectively. Other boats were given trials including a cabin cruiser fitted with a jet engine. Mr. Callis is at present working on a " Seal Major " 30 c.c. four-cylinder engine which he proposes to install in a tug of the " Gondia " type. We welcome news of this nature from our readers in the remote corners of the earth, and to our New Zealand readers we extend our best wishes, in the traditional Maori greeting—" Kia-Ora ! "

L.B.S.C.'s Lobby Chat

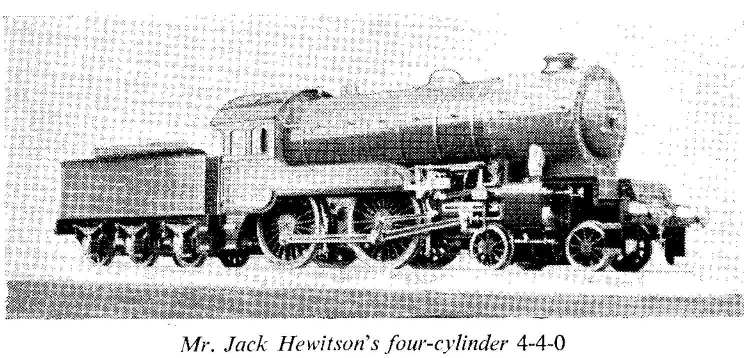
● A CANADIAN-BUILT "SUPER" 4-4-0

IF anybody about to read these notes, belongs to that well-meaning but misguided clan whom I nicknamed "scale fanatics," he had better turn the pages over right away, or else have a tot of brandy and a bottle of smelling-salts handy; because I'm giving a short account of a grand job of work that is like nothing running anywhere in the world today. Mr. Jack Hewitson, of Montreal, started to build a huge 4-8-4 of the Canadian Pacific pattern, in $3\frac{1}{2}$-in. gauge, and it became so heavy to handle, that he couldn't shift it single-handed, from work-bench to table, without taking the boiler off the chassis. Incidentally, that is just one of the points I'm everlastingly trying to drive home to beginners who have only a small workshop and limited trackage space, and write and ask me umpteen questions about building a 5-in. gauge *Britannia* as a first attempt! Well, after shifting the locomotive by instalments, six times in one evening, Jack became rather browned off—not with the locomotive, I hasten to add, but with the transportation business—and decided there and then, to give it (and himself) a rest, and have a go at a locomotive that *could* be lifted without the aid of the breakdown gang and a steam crane.

Regular readers may remember the description I gave of Mr. Holcroft's conjugated valve-gear for a four-cylinder engine having the cranks set at 135 degrees, as on the Southern *Lord Nelson* class. My *Tugboat Annie* was the first engine to be fitted with it, and I have incorporated it in the design of the ground flying-machine *Queen Mabel*. Friend Hewitson was so tickled with this, that he made up a set, increasing the dimensions to a size suitable for a $3\frac{1}{2}$-in. gauge engine, and mounted it on a plate, so that it could be operated. When he decided to build a small type of $3\frac{1}{2}$-in. gauge engine, he thought it would be a good wheeze to arrange the working parts, so that the gear could be utilised; and the photographs show the result. The engine is a cross between a Southern *Schools*, and the North Eastern "R1" class 4-4-0 which I described about twelve years ago, and nicknamed *Miss Ten-to-Eight* on account of her number being 750, same as my gasoline buggy.

A Bit of a Wangle

The resemblance to the latter engine can be seen in the photographs, and she formed the basis of friend Hewitson's design. A pair of outside cylinders, naturally. were required, and these were adapted from those I described for *Hielan' Lassie*. They have $\frac{1}{2}$-in. piston valves, and the pistons are of dural, $\frac{13}{16}$ in. diameter. Two of my "standard" mechanical lubricators are fitted, each supplying two cylinders, oil being fed into the steam pipes. Valve-spindle guides are fitted. The valves of the outside cylinders are actuated by Baker valve-gear, with girder type frames; the valve spindles are extended through the front of the steamchest, and the connections for operating the Holcroft gear are attached to them, the pictures showing the arrangement clearly. A difficulty arose when our worthy friend went to fit the reversing gear, as the reverse shaft could not be placed in the usual position behind the gear frames; so he fitted it ahead of the gears, the short reach rods being connected backwards to the reverse yokes, the long rod from the cab passing between the boiler and splashers.



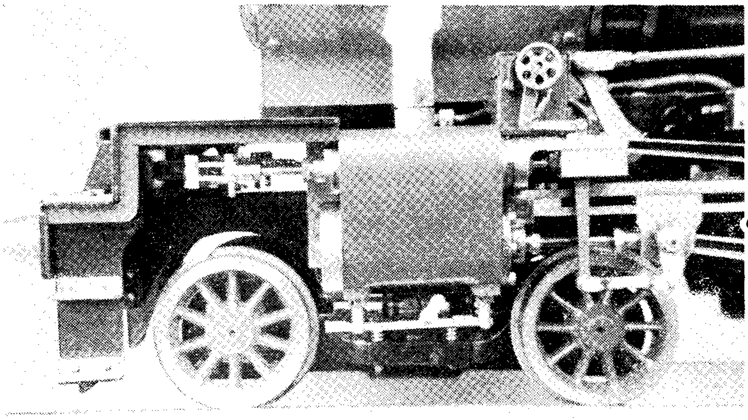
Mr. Jack Hewitson's four-cylinder 4-4-0

The reversing screw arrangement is first cousin to that used on the *Britannia* class. The screw, and the guide for the nut, can be seen alongside the right-hand valve-gear in one of the pictures, the nut being connected to the arm on the reverse shaft by a short rod. The screw is connected to the rod from the cab, by a simple universal joint. This prevents any movement of the gear which might result from the whipping of a long reach rod.

The boiler is made exactly to the instructions given for the North Eastern engine, and was as tight as a bottle on a test water pressure of 180 lb. The boiler mountings are according to specification, but the fittings on the backhead and in the cab are varied. The water gauge is mounted on a column, as is usual in transatlantic locomotives, and is electrically lighted; the lamp and wire can be plainly seen in the cab view, also the socket for a two-pin plug connection at the right-hand end of the drag beam. To counteract the excessive weight at the leading end, due to the use of four cylinders, the seat-boxes are solid blocks of lead. The injector, made to my specification, does the job all right, and is located under the floor of the cab, the handle of the water-regulating valve projecting up through the footplate on the left-hand side. The corresponding handle on the right side, operates the bypass valve of the feed pump.

"Invicta" Jumps the Queue!

Bro. Jack says that it was his intention to carry on with the big 4-8-4 after finishing the little 4-4-0, but has taken a fancy to *Invicta*, and now the big girl looks like being shelved for a further period, whilst yet another edition of "the old



Left-hand side, showing Holcroft gear connections

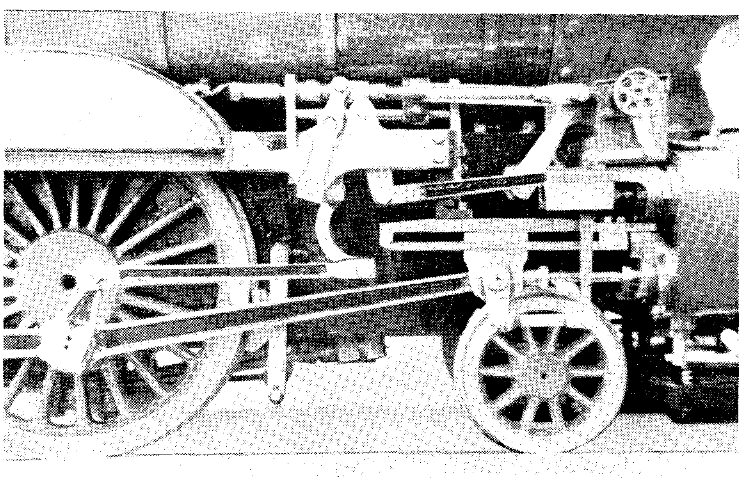
lady who stands in the market place" is brought into being. Incidentally, I'm open to bet that the designers and builders of the first locomotive to haul passenger trains in the south of England, hadn't the faintest idea that over a hundred-and-twenty years later, literally hundreds of little copies of her would spring into being all over the world, and would also haul passenger trains in a manner, and at a speed, that they would not have imagined to be possible, even in their wildest dreams! Well, it is the unexpected that always happens, and truth was ever stranger than fiction. In that connection, I might mention here, that several folk of "superior knowledge" laughed very derisively at my tales of the future, saying that the speeds attained by the locomotives in them, were impossible. Don't be too sure!—it may be impossible for an elephant to ride on the back of a mouse, but it was once said that the human body could not stand the stress of travelling in a train at thirty miles an hour. Neither could a steam-driven vessel cross the Atlantic Ocean; anything heavier than air could never fly. But the "nevers" have all become actual facts; and now that human beings have travelled faster than sound itself, in an aeroplane, it doesn't appear to your humble servant that the gap between the 126 m.p.h. of *Mallard*, and the 181 of *Queen Mabel*, is so very great after all!

Anyway, I guess most readers will join in offering hearty congratulations to our friend, on the design and construction of a little locomotive which goes as well as it looks, and is a clever embodiment of tried and tested mechanical principles. Personally, I am of the opinion that an engine of this sort is a far more meritorious job than all the "scale" replicas ever shown at a club or exhibition. The champion fault-finders would, of course, find plenty about which to raise a quibble; for example, the hinges and straps on the smokebox door, and other items which do not matter a bean, and don't affect the efficient working of the locomotive. Once upon a time, I happened to meet a critic whose pet "phobia" was to be everlastingly moaning about people who used screws with slotted heads, instead of using hexagon heads. So much so, in fact, that I fully expected to see a hexagon head on his own shoulders. To my great surprise, his head was not only more or less round, but on top of that—literally!—was a hat with what looked suspiciously like a glorified screwdriver slot in it.

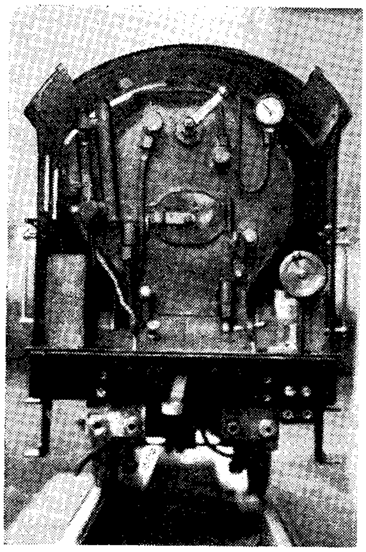
Cast Fireboxes

Several readers have called my attention to an advertisement in an American magazine, giving a preliminary notice of a $4\frac{3}{4}$-in. gauge 0-6-0 switching locomotive, for which the advertisers are intending to sell castings and parts. Among other things, they claim that the boiler is an innovation, inasmuch as the firebox, wrapper sheet, staybolts, crown stays and mud ring (or foundation ring as it is called in the U.K.) form a one-piece casting; and they claim that the boiler can be completely finished in one day's work. The correspondents ask your humble servant's opinion on this, as a practical proposition, one of them jokingly suggesting that the firm might as well go the whole hog while they are about it, and cast the complete locomotive as a single unit—painted and lined as well, if the lines could be prevented from going crooked while the casting was cooling off!

For the start, the cast firebox, complete with stays and mud-ring, is no innovation at all; it is, in fact, ancient history. Back in 1930, when I was over in the U.S.A., I saw a firebox cast in copper, with a heavy flange all around the bottom, to form the mud ring, and ribbed sides and top, to form the staying. The box itself was over $\frac{3}{16}$ in. thick, and the ribs were much thicker, as they had to be drilled and tapped for $\frac{1}{4}$-in. screws holding the wrapper sheet in place. There is no gainsaying the fact that a boiler, with a firebox and staying of this description, is easier and quicker to build, than one made completely of plate material, with separate staying; but it is just another case of "what



Right-hand side—note reversing screw behind Baker gear



Cab fittings—note electric gauge lamp

you gain on the swings, you lose on the roundabouts." The boiler, when completed, wasn't in the same street with an all-plate boiler of similar size, made in accordance with the principles laid down in these notes, and built to my instructions. It took no end of a time to get up steam, and needed a miniature edition of Hades in the firebox, to maintain the working pressure; and it didn't always do that much !

I don't believe in cast fireboxes, nor cast plates of any kind, in a boiler; not even in the watertube type. In past years, when I had time to spare, I did a fair amount of overhauling and repair jobs for friends and acquaintances, and came across several cases of boiler trouble, due to castings being used. To simplify the boiler construction of their engines, two or three firms adopted the "cast-backplate-and-downcomer" stunt for the spirit-fired watertube boilers with which their engines were furnished. This certainly didn't add to the already poor efficiency of the engine, as the metal (usually soft brass) was nearly ⅛ in. thick, and it takes a dickens of a lot of "liquid poison gas" to heat up that mass of metal, and keep it hot, especially when the cylinders and valve-gear were nothing to write home about, and mopped up far more steam than was necessary to do the job. Carson's tried the same thing when they put their super-cheap locomotives on the market; but although they fired the boilers with vaporising paraffin (or kerosene, as our transatlantic friends call it) burners, and their cylinders and motion were beyond reproach, they found that the idea was—literally !—"not so hot" and discarded it for a plain barrel with bent water-tubes. Old Jim Carson couldn't tolerate inefficiency in any shape or form, and that is why he eventually quit the business. I know the full story, straight from the horse's mouth, in a manner of speaking, but it has nothing to do with these notes.

I remember once reading an advertisement in an American journal, which offered a set of castings and parts for building up a fairly large engine of simple type; to the best of my recollection, it was somewhere around 10-in. gauge. No parts were supplied for the boiler; this was a sort of marine type with a single flue, fired by means of an enormous oil burner blowing into the cab end of the flue. The instructions called for a piece of cast-iron tube (same as used for gas and water mains) for the boiler barrel, and said that all necessary fittings, including a safety valve, could be obtained from any hardware store. I never heard of one of the engines being built ! Personally, I'd be scared stiff of being anywhere near a boiler of that description; "boiler" is hardly the right term—a more apt one would have been "steam bomb."

Reverting to the first paragraph, the firm in question have been in the trade long enough to know a bit about boilers, so I wouldn't query the "safety" part of the boiler with the completely-cast inside to it; but the efficiency of it is what my old granny would have called "a horse of another colour." Time proves all things; and if one of the engines were built with the boiler as specified, and another with an all-plate separately-stayed boiler, I should have no hesitation in saying that the latter engine would give the best results in a comparative test.

Adventures "Over the Pond"

Writing about the American cast firebox, reminds me that several readers want a reminiscence or two, about what happened when I visited the 3½-in. gauge railway to which I was invited, as mentioned in my recollections of the little exhibition in New York City. I was too shy to go "solo"; and as Calvert Holt knew the owner of the line, and had a standing invitation, we decided to go together, and notified the "big shot." Holt, of course, had a car, a whacking great Chrysler, and we could have gone on that, in fact we did, after the first trip. However, as the "big shot" had said he would send one of his cars to the local station, and I wanted an American train ride, we went by road from Greenwich, Conn., to Harmon, where the New York Central main-line trains changed from "juice" to steam traction, and vice versa, according to which way they were going. The engine that pulled our train, was the first Baker-gear locomotive I had ever ridden behind; and if I had shut my eyes as she pulled out, I could have easily imagined we were leaving Paddington, for she barked exactly like a Great Western *Castle*—and boy ! *could* she accelerate. We duly arrived at the local station, well on time, and the car was there to meet us; so we were soon greeted by the "big shot," and enjoyed a hearty meal, after which he took us to see the railway, on a tin Lizzie which he kept especially for running about the grounds. Some grounds they were, too, and entirely unfenced; kids used to come in and sneak rails and other oddments !

The Railway

The line was about a mile long, single track, with a large loop at each end; it was mostly at ground level, but there were cuttings and embankments (they are known as "cuts" and "fills" over there) and bridges. There were several sidings, and a roundhouse, with a turntable, for the engines, five altogether. The line was signalled where there were any points, or switches, as American railroad men call them, and the switches could be thrown by the driver of the engine without stopping. Just ahead of each switch, was the operating handle, which consisted of two upright bars about four feet apart, connected by a crossbar. The switches were interconnected with upper-quadrant semaphore signals; and if the signal was set for the wrong road, all the driver had to do, was to reach out as he passed the operating gadget, grab the bar and pull or push it, as the case might be. The northern loop was situated close to the roundhouse; and the switch leading to the latter, was located near the end of a long trestle bridge on a falling gradient. The line undulated, the steepest grade being 1 in 75, in a cutting. The rolling-stock consisted of ten flat cars, some on four-wheeled bogies, and some on six-wheeled ditto. They were heavily built, but ran on ball bearings, and each had the tare weight painted on the frame.

Steam was raised in one of the engines, and we went for a trip.

The " big shot " operated the engine by sitting on the car immediately behind it, putting his legs on each side of the tender, and resting his feet on two footrests at the front end of it. Holt either drove the engine the same way, or else knelt on the first car and leaned over the tender. When it came to my turn, I was in a bit of a dilemma, because I couldn't " straddle," and was scared of the kneeling position on a narrow car; but the " big shot " said if I could sit on the tender, it would carry me all right, so I did the Victorian horsewoman stunt, and was just able to keep my shoes off the ground. We made several circuits of the line, and I " learned the road " *a la* full-size practice.

Shed Day Needed !

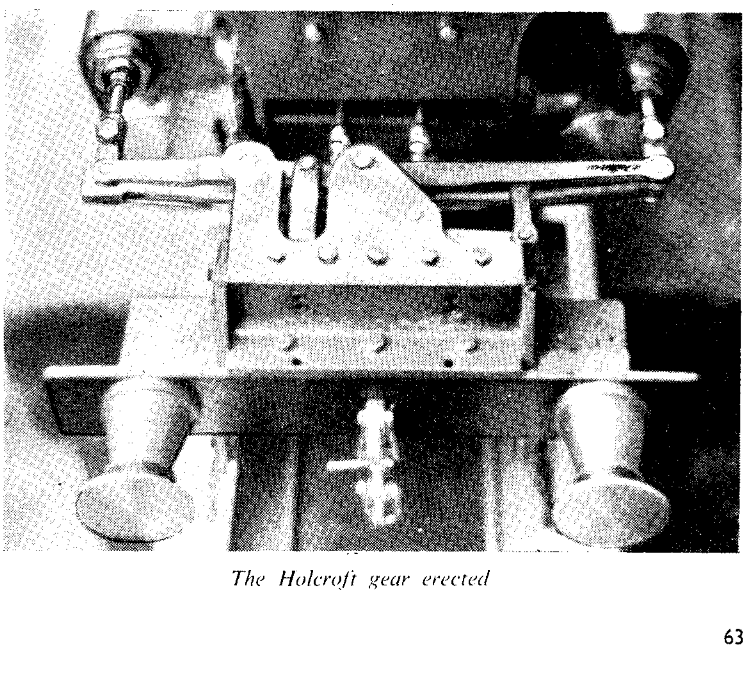
The " big shot " asked my opinion about the running of the engine, and I told him frankly she didn't come up to expectation (I'll say she didn't !) so he said, how would it be if he sent her to Holt's place, and would I give her a shed day. I said O.K. with pleasure, and we departed for home. I was rather intrigued by the signal lights on the homeward journey; they were " approach lighted," that is to say, they only lit up when a train was approaching, though soon enough to give the driver adequate warning, and they went out as soon as the train had passed. I saw them operating on the opposite line. I understood the current was supplied by primary batteries (Daniell cells) and thought this idea would have been fine for British branch lines where the trains run only four or five times a day. We arrived at Harmon, went home from there on the car, and called it a day—and an enjoyable one at that.

The engine arrived a few days after, and I did the needful to her in Holt's workshop. No wonder she was a poor performer in my estimation; she had solid block pistons with neither rings nor packing ! Anyway, I soon cured that, attended to the valve gear and lubrication, and did a few more oddments, and about a fortnight later, we took her home on Holt's car. The " big shot " was away on business, so we had the line to ourselves. Holt was a " mad " driver, and had wrecked three cars, so his wife told me. Incidentally, though he had no need to work for a living, he got a job firing on one of the railroads, " just for the hell of it," he said. One night he was on a switching (shunting) job, and carried on during the temporary absence of the engineer (driver). There were some box-cars to pull out of one of the tracks in the yard, and as no switchman (shunter) happened to be handy, he started the engine very slowly, jumped off, held the switch lever while the engine ran over it, and then ran after the engine to stop her; but she was a bit too quick for him, and made a lovely pile of wreckage at the far end of the yard. That put paid to his railroad career ! He told me the story himself, with great gusto.

Well, we duly arrived, got up steam, and had a glorious time, taking it in turns to drive. The few good folk who have driven my own engines on my own little railway, know what my engines can do—no " hot air " intended—so they will believe me when I say the American engine was improved almost out of recognition. With only two cars on, and a two-adult load, she just flew up the banks, and needed very little fire; but Holt was never satisfied unless he was going all out, and he barged up the grades with full throttle and the lever well down, the engine sending up showers of sparks and red-hot cinders. I was wearing a flimsy brown overall coat brought from England; twice it caught fire, and at the end of the run, the shoulders and part of the front was a mass of sparkholes, and I had to shield my face all the time.

One of the funniest incidents I have ever experienced took place on this run. The " big shot " had a couple of hefty dogs; I don't know the breed, being ignorant of dogology, but they were friendly creatures, and would gallop along by the side of the train. At one point on the line was a small hydrant and hose, for filling the tender tanks. We had stopped by the " water plug," as they called it, put the hose in the tank, and was filling up, when one of the dogs came sniffing around, apparently thought that the tank wasn't filling fast enough, and decided to help matters along, in the manner usually observed among the canine race. He scored a bulls'-eye, too ! Holt had his camera handy and tried to get a shot, but was laughing so much that he couldn't hold the camera steady enough. Well, I've about overshot the platform on this run, so will cut it short, and just say that we left the engine O.K., and when the " big shot " tried her, he was so delighted that he asked me if I would do the rest of the fleet. I was only able to do one more for him; and what happened when we took that lady back, I'll tell you (all being well) in another lobby chat.

USEFUL BOOKS



The Holcroft gear erected

The MYFORD "Super Seven" Lathe

SINCE its introduction soon after the war, the Myford " M.L.7 " lathe has earned a wide popularity, not only in amateur workshops but also in the field of light industry. By reason of its particular features of design, and methods of production, it has been possible to put it on the market at a price within the reach of the average amateur, without sacrificing essential accuracy or utility. Although this policy has been highly successful in practice, and innumerable readers of THE MODEL ENGINEER have testified to the usefulness of the " M.L.7." it has necessarily imposed certain limitations on details of design, and the makers have devoted a good deal of attention to improving these without departing from the general design or production scheme. It is worthy of mention that many factories dealing with small components, some of them made to fine limits, employ " M.L.7 " lathes, and they are also employed in many repair and servicing depots. The Cable and Wireless Co., for instance, have " M.L.7 " lathes installed in their wireless stations all over the world.

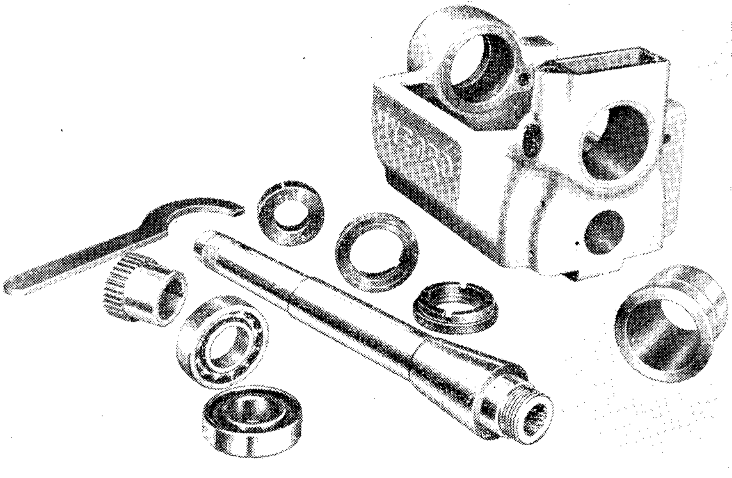
The new " Super 7 " lathe has been designed primarily to meet the demands of industrial users for a lathe capable of higher spindle speeds than the standard " M.L.7." While it has been improved in many important respects, it is not intended to " supersede " the latter, in the sense of rendering it obsolete, as it is adequate for most purposes where the higher speeds and exacting conditions of industrial production do not apply. The improved features include an entirely redesigned headstock, with modified mandrel and bearings, and more critical control of lubrication; an extended range of mandrel speeds, and control by friction clutch; a longer cross slide, with full swivelling movement of top slide; steel feed-screw indexes with friction setting, etc. With these exceptions, basic design is much the same as the " M.L.7 " and little alteration has been made in the bed and other main components.

The most important improvement here is the employment of a tapered front bearing, and the use of a double angular-contact ball-bearing at the rear end. This not only enables heavier thrust and radial loads to be sustained, but also facilitates critical clearance adjustment in both respects. The mandrel is case-hardened, and its tapered form gives it inherent stiffness; it runs in a bush at the front end, and is lubricated by controlled drip feed from a large reservoir formed in the headstock casting, the oil entering the bearing at the bottom.

The drive to the mandrel is by a four-speed vee belt pulley, with back gearing located below, as in the " M.L.7." In cases where lathes are run at high speed, frequent stopping and starting imposes abnormal duty, not only on switch contacts, but also on the motor windings. In order to avoid possible trouble from this cause, a friction clutch is incorporated in the countershaft, which is driven from the motor by a two-speed pulley, giving a total of 14 speeds (8 direct and 6 through back gear) from 2,150 to 25 r.p.m. A quick-acting plunger lock is provided for direct coupling of cone pulley to mandrel.

The back gear has been strengthened, and employs gears of 16 d.p., the large gear on the lathe mandrel having 60 teeth, thus being useful for indexing purposes.

The general design of these follows fairly closely that used on the " M.L.7," including the use of self-lubricating bushes in the rack and pinion gearing, general provision for lubrication of slides, and the fitting of renewable nuts to feed screws. A redesigned cross slide and boring table, having a traversing range of $5\frac{1}{8}$ in. and long enough for comfortable use of a rear tool post, is fitted. The top slide is located by means of a large dovetail spigot,



The headstock dismantled, showing mandrel, with tapered front bearing, and double angular-contact ball-races in rear bearing

and locked by means of horizontal screws which have a wedging action to pull the base firmly down to the boring table. It is thus capable of 360 degrees swivelling movement, and can be removed completely in a very short time when the boring table is required for fitting other attachments.

The design and arrangement of screw-cutting gear is the same as on the " M.L.7 " and uses the same 20 d.p. gears, but improved methods of mounting the change wheels are incorporated, enabling the studs to be locked in place in the quadrant from the outside.

In place of the former die cast indexes, engraved dials are fitted, with provision for initial setting by means of a friction device; and improved means of thrust adjustment for the feed screws, and also of locking the ball handles, is also provided.

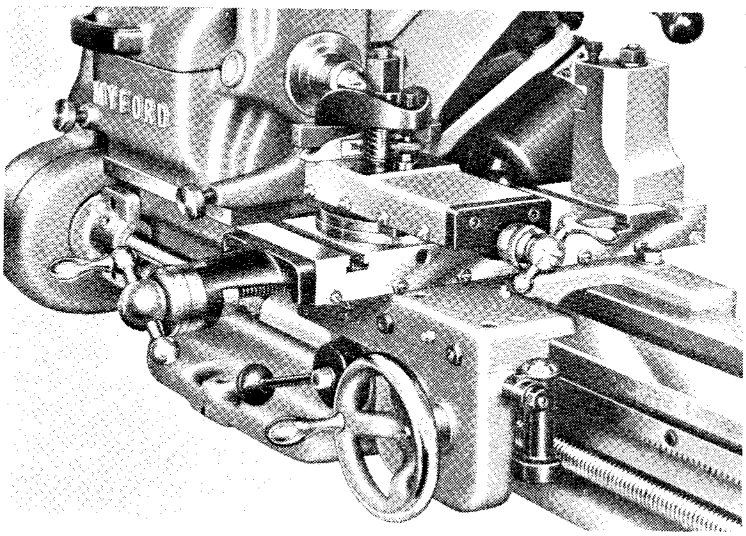
The design of the tool post, with its self-aligning spherical thrust washer and swivel-based adjusting jack-screw, is generally unchanged.

This is built on to the rear of the lathe bed, behind the headstock, as in the " M.L.7 " and its arrangement is generally similar, but it differs in several important details. The structural members carrying the motor and countershaft have been stiffened to prevent possibility of deflection under heavy belt pull, or the binding of bearings, and special provision has been made to prevent the possibility of distorting the bed of the lathe by reason of the weight of the motorising attachment. All guards are hinged for easy access, and fitted with captive bolts, also oil-resisting rubber pads to eliminate noise and vibration.

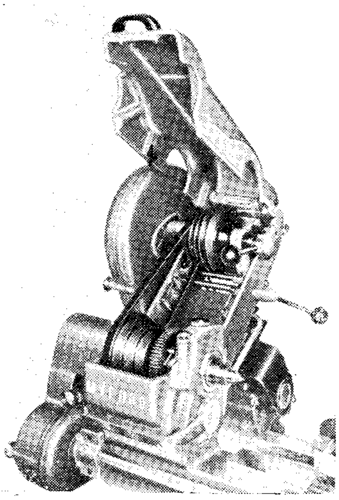
An entirely redesigned belt guard from countershaft to mandrel is provided, having shakeproof locking devices for both open and closed positions.

Cam operation for releasing the belt tension when changing speed, with adjustment by screwed cam followers, is retained, also the use of a hinged motor platform for adjusting primary belt tension. Needle roller-bearings are fitted to the countershaft, and the cone pulley is not positively attached to the shaft, but driven through a large-diameter friction clutch of the internal expanding type, the operating lever of which is conveniently located at the right-hand end.

All the attachments and accessories for the " M.L.7 " can be fitted to the " Super 7," including vertical slides, dividing attachment, etc., and the mandrel thread and register are also the same, so that chucks are interchangeable. Some new accessories have recently been introduced, including a silent cluster gear with " Tufnol " pinions, and a special fine-feed cluster gear which enables a feed of about 0.002 in. per revolution to be obtained.



The improved saddle, with full swivelling top-slide and long cross-slide, with rear tool post in position



Headstock with belt cover raised to show countershaft, with clutch and cone pulleys

TWIN SISTERS

by J. I. AUSTEN-WALTON

NOW we come to the sight-feed system, which is coupled to the oil tank described in the previous article. It is reproduced full-size to give you a better chance of working to the drawing. First, get your glass tubing, and more or less build the fitting round that. The size given is $\frac{5}{16}$ in. outside diameter, and anything much larger than this will entail an increase in the top thread size, which is $\frac{7}{16}$ in. × 40 t.p.i. in this particular case. The next standard step up is to $\frac{1}{2}$ in., which is quite a lot when you are working with such small fittings.

This reminds me of something that happened at THE MODEL ENGINEER Exhibition. A "Twin Sister" builder brought along a set of sanding gear parts for approval. He had taken the trouble to make up a set of screwing tackle in the 60 t.p.i. range, which enabled him to reduce the outside diameters of the unions and the ejector body.

The difference was most pleasing, and I told him I preferred it to my own arrangement and specification. I fear not many builders would go to all that extra trouble in order to make a reduction in proportions. My own view is that time so spent, is not wasted. I am sure that sets of very fine thread taps and dies would be invaluable in the making up of delicate fittings and I shall probably set about making some for myself later on. I can think of cases where a 100 t.p.i. would be almost ideal. What about it ?

To revert to our sight-feed fitting, having obtained the right size of glass, the next job is to cut it and grind its ends dead flat. Cutting glass of this size is easy if you have plenty of spare glass; by this I mean that you have confidence which is all you need for glass cutting. If it is the only piece of tubing in the world, it is bound to break up into small pieces; but given a foot length, then the first one comes off perfectly. To cut the tube, make a tiny "nick" with a fine, three-cornered file, in just one place; take the tubing between the fingers and snap the piece off. If this is done with wild abandon, the result should be satisfactory.

To get the ends flat and square, I suggest you rub them down on a bit of oil-stone, using water as a lubricant. Do *not* try grinding the ends on the side face of the tool grinder—I have seen nasty accidents happen through flying particles of glass, and it takes but a speck to damage the eyesight for life.

Now you can set about making up the jets and unions, taking as much care with the lower jet as you would with an injector cone. The important thing here is the very small hole up the middle. Keeping the neck of the jet to fine proportions also has a bearing on its future operation; oil is funny stuff to play with, especially in the vicinity of glass tubing, and its ability to "creep" is the main trouble with sight-feed fittings. Keeping the outside neck of the jet fine, reduces the "creep" area, and so reduces the possibility of oil fouling the glass.

The upper jet, or collector cone should also have a fine lower lip, and should be free from rings or sharp ridges in its entrance flare. Keep this part to a close fit in the bore of the tube, so that the escaping bead of oil from below, has little chance of getting past the edge.

The seal of the glass tube in its housing is by means of two jointing rings, made from "Hallite" or other suitable material. As there is no escape space for the jointing, even thin cork washers should provide a satisfactory seal, and this is very kind to the glass tube when under pressure. Once the unit is made up, a simple pressure test should prove the absence of leaks; but once more, if the test is with air, make sure to protect the eyes in case of a tube breaking up and flying out.

At the present stage of things, you will not have a place to install the fitting; this goes on the bunker top shelf, on the left hand side, and is screwed on to the control valve directly underneath and out of sight, except for its operating handle.

On the prototype, the sight-feed fitting is screwed to the left-hand side of the cab, just beside the reversing lever. Its actual length to scale would be about $\frac{1}{4}$ in. and I do not think anyone would want to make it, even with some 100-t.p.i. taps to hand. In any case, it would hardly be capable of working in such proportions, and certainly not visibly !

Having the fitting where it is planned gives the driver a good clear view of the oil feed, and with the bunker back in place, the looks of the engine are not spoiled. Also it is rather important to keep the oil reasonably cool before it enters the main feed pipe to the cylinders, after which it can get as hot as it likes. This temperature control reduces the "creeping" characteristics of the oil, and tends to keep it more or less in the form of a solid "bead"—just what we want, of course. You should be able to judge the speed of feed by the number of tiny beads that pop up the glass every minute, or suitable period, and finally, even oil tends to emulsify with water when it reaches a certain temperature, and that is when the glass tube becomes fouled, and the feed of oil invisible. G.W.R. Driver Maxwell told me that he had largely got over the fouling trouble by putting a little salt in the glass before operation; the salt naturally mixes with the water, and further resists any tendency for the two to "mix." The water in the tube, being condensate, remains there always, and there is no fear of the salt water getting down into the cylinders. I am hoping that there will be no need to use salt, but should the need arise, this is a tip worth remembering.

The Control Valve

This is really a very normal type of valve such as is found in the wheel-valve for general purposes. The only deviation is in the fitting of a ball instead of the usual needle seating. The ball will, as a rule, give a better steam-tight seal than the needle, and as we are dealing with a very minute flow of oil, it is essential that the valve gives a most definite "off" position, and an easily controlled flow from there, upwards, It is unlikely that the valve will ever need to be full on, but more in the nature of a cracked seating to give a fine "weep."

There is one feature you will find in the construction of the valve, and I use it as standard for all my fittings of this type. The valve spindle itself is quite slender, a good point to start with, especially from the scale aspect. The screw thread on it, engages with the body thread direct, and a plain washer is then threaded over the spindle, to rest

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Continued from page 20 "M.E." January 1, 1953

at the bottom of the larger thread in the body. Packing is now put in, and the gland nut tightened down. This type of gland is much neater and even stronger than the bonnet type. The bonnet of the wheel valve is usually the part most out of scale, and yet with this arrangement it is so easily avoided. Further, the spindle has a definite stop position when full open, and no packing can get down into the valve inside. No handle is shown for the valve on the drawing, but I suggest the single type of handle as used on gauge glass fittings; this has the advantage of neatness, and forms a sort of repeatable index, like a pointer, by which one can remember particular settings for satisfactory operation.

Sitting thinking about the entire outfit here described, I feel I should go back to the sight-feed fitting with a sort of final warning. If the glass should leak in the fitting, the result will be the loss of the residual water in it, and this will be followed by the oil that will take its place. Once this happens, the oil will creep up inside the glass, and all visibility will be gone. This should be a sort of warning that every joint on the fitting must be correct and tight. I have an idea that once this condition obtains, there will be no further trouble; but we will wait and see !

Brakes

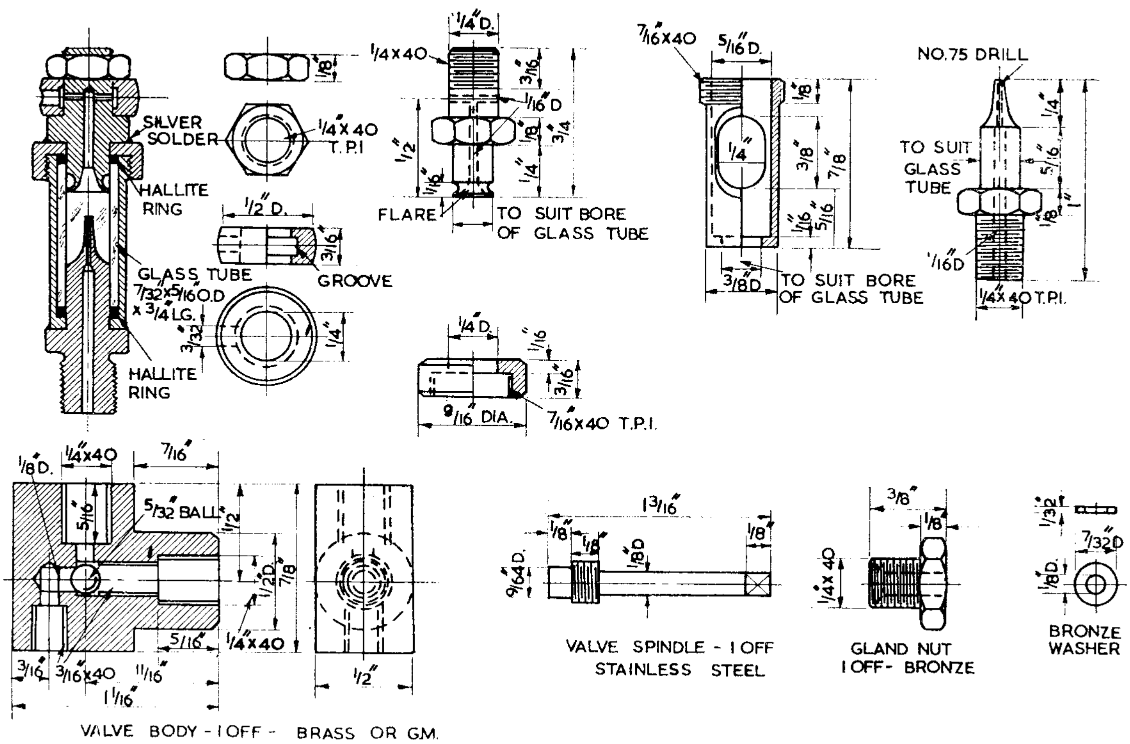
Quite recently, I had the pleasure of meeting once more with Mr. Marchant, son of the late A. W. Marchant, whose lovely work was almost legendary. Mr. Marchant has a keen interest in locomotive matters, and has doubtless inherited much of his father's skill, which should be a matter for great rejoicing. He tells me that he has been experimenting with a brake ejector valve that also has had senior's attention in the past. Carrying on with the work has produced its own reward, and the little fitting is so efficient that it can be left " on " continuously without having any draining effect on the boiler. It achieves a vacuum (checked on a full size gauge) of 18 in., a mere 2 in. less than the corresponding fitting on the prototype ! Now this is " going places " in no small way, and it opens up great possibilities for a satisfactory continuous braking system for the passenger-hauling class of rolling stock. We have been in great need of a system where just a bit of hose could be pushed over a nipple between cars, so that a detached car would automatically apply the brakes. Each car would carry its vacuum reservoir and a simple version of the triple valve, and complete realism into the bargain.

Mr. Marchant has actually had the system on test, although I do not think he has yet added the other refinements; but he tells me that it works like a charm, and keeps on working without any sort of trouble. He is sending the valve, which is the heart of the system, on to me when he gets a spare moment, and I have been invited to take it to pieces for examination. It might be possible to give a full account of its working and construction, for the benefit of all interested readers. As it happens, I have already worked out a brake linkage for eight-wheeled bogie cars, which completely compensates on all wheels, and entirely ignores the swing of the bogie. With this coupled to a large brake cylinder, and all refinements added, it should provide the ideal solution for continuous braking.

Other Snags

I was asked whether, in the course of construction of the original " Twin Sister," I had encountered any real snags. I had to reply that, other than the smaller difficulties faithfully reported from time to

(*Continued on page 70*)



Model Power Boat News

BY MERIDIAN

FACTS AND FIGURES !

DURING the period of THE MODEL ENGINEER Exhibition, a rallying point for model power boat enthusiasts, is, of course, the M.P.B.A. stand. Club members and also lone hands take the opportunity of a chat with the stand stewards on many topics of interest, and from these impromptu meetings, information is exchanged on all sorts of power boat matters.

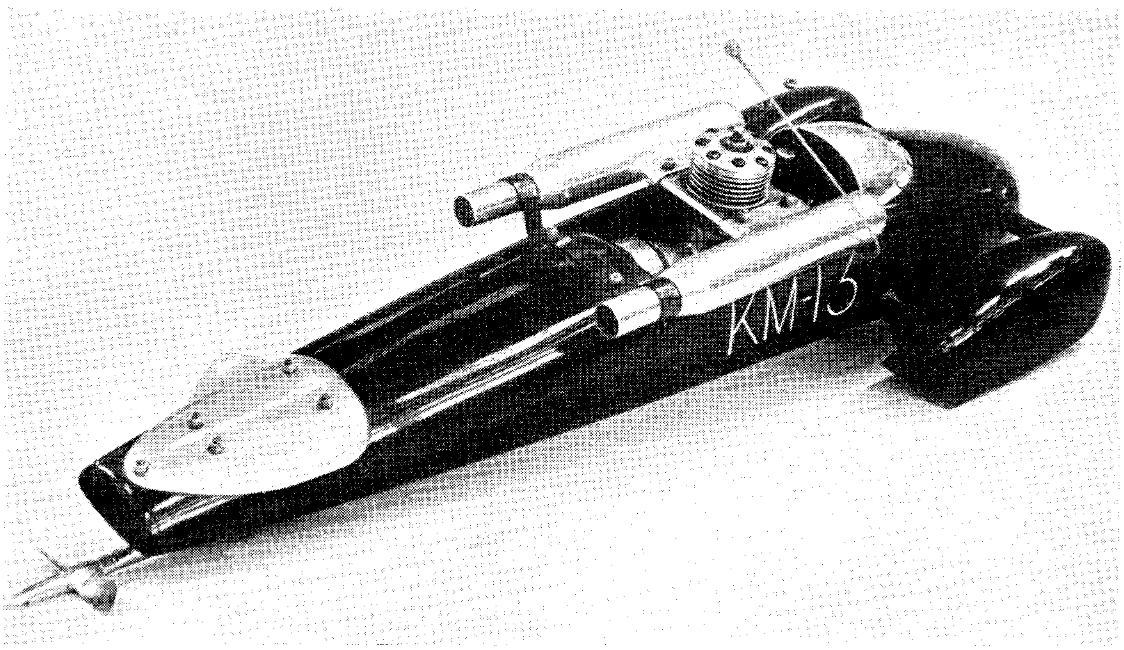
From the opinions expressed at some of these little meetings, I gather that many would-be speed boat exponents are somewhat overawed by the high speeds that have been attained by some of the well-known hydroplanes that frequently compete in racing events. There is a definite reluctance to enter " first attempts " at hydroplane building, since the speed is almost certain to be fairly low when compared with other boats in the regatta.

Whenever this view is expressed, I always endeavour to give reassurance to potential competitors, and explain that their efforts will never be regarded with disdain by other power boat men, but rather with sympathetic interest. Everyone has to make a start sometime and most exponents of hydroplane racing have well and truly been through the mill ! It is an achievement to produce a boat to run satisfactorily at all, let alone consistently at high speed.

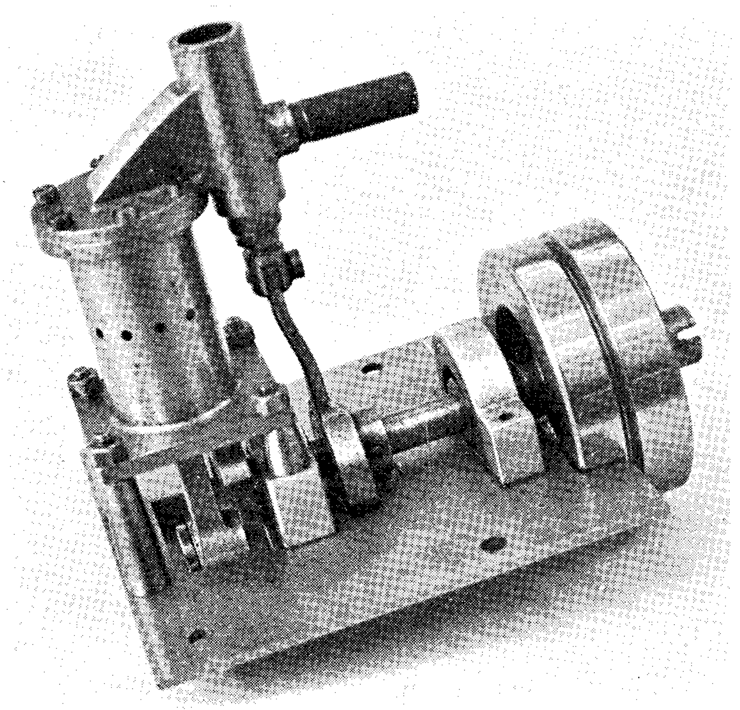
The figure of the existing records should not deter the beginner too much, since at most regattas in this country, the usual winning speeds are much lower, and places are often taken at quite moderate figures.

A query about average speeds prompted a little research into the regatta results for the past few seasons, from which emerge some interesting facts. The results are from 1949-52 inclusive, and show an average of the winning speeds in the various classes in m.p.h. The figures in brackets show the number of races from which the average is obtained:

Class	1949	1950	1951	1952
'A'	49.4 (9)	46.7 (16)	54.8 (15)	57.2 (13)
'B'	41.9 (12)	49.9 (16)	52.1 (14)	51.5 (13)
'C'	34.3 (8)	40.1 (14)	52.6 (13)	50.1 (12)
'C' Res.	36.6 (10)	42.6 (13)	49.2 (14)	55 (13)



A typical Class " D " (5 c.c.) hydroplane by Mr. M. Karslake



A single-acting piston valve engine by Mr. Drayson

The Hispano-Suiza and Ford races held in 1950 and 1952 have been omitted as also have Continental regattas, but all other known results are included. The Class "A" average is the highest in any class for three of the years shown, but there is not a great deal between the different classes for the 1952 season.

The larger boats have obviously an advantage in running better on disturbed water than the smaller ones, although the highest official record—over 75 m.p.h.—is still held by a "C" Restricted boat. Under favourable conditions, this class is still the fastest, but the gap shows signs of closing up.

The home built constructors have the task of developing both hull and engine together, whereas if an engine of known high performance is available, work may be concentrated on hull improvement, etc.

Experience

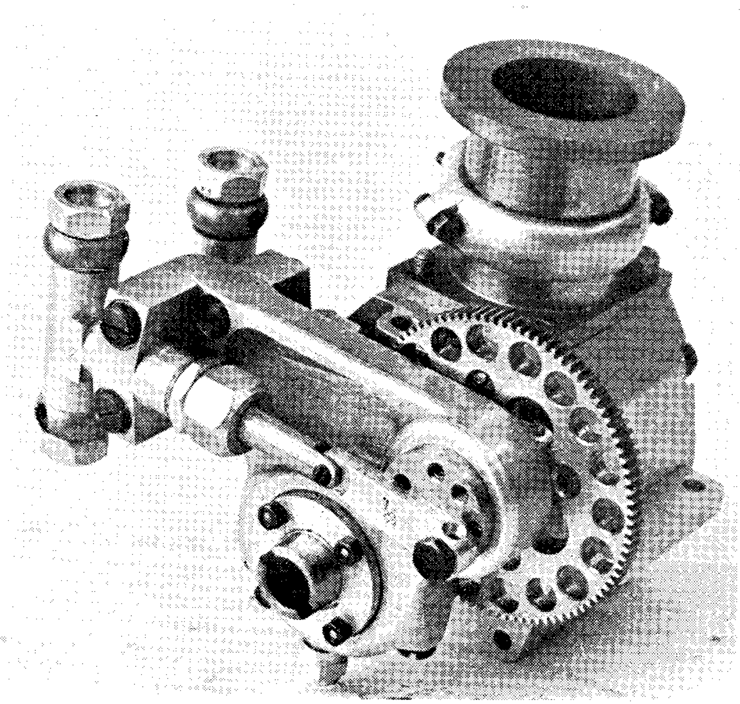
Some exponents have run a "C" restricted boat for a few seasons before building an engine themselves, and thus gained valuable experience in hull design. For those without facilities for engine construction, this class offers the beginner a reasonable chance of success, and also an opportunity to gain much experience in the *running* of speed boats.

This last point is an important but often neglected one, and is frequently the biggest factor in the lack of success of newcomers to hydroplane racing.

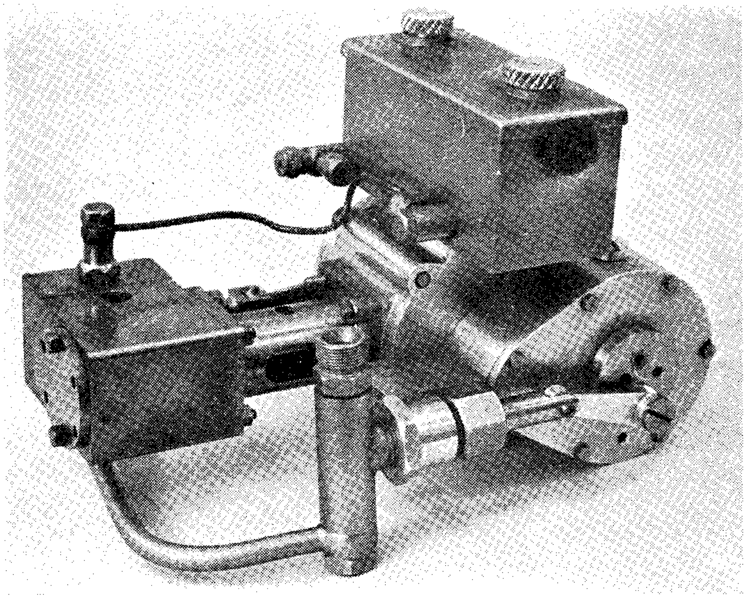
Visit a Pond

Whatever class boat is decided upon, I would advise the beginner to try and see some speed boats in action before building the hull. Actually seeing the boats and being able to examine them brings home many points of essential design that might otherwise be neglected. Most power boat men are only too pleased to give helpful advice if approached, and I would venture to say that there are few present experts who have not been advised by more experienced exponents at some time or other in their career.

Returning to the speed question, my opinion is that if a boat can be made to perform between 40 and 50 m.p.h. regularly, it provides formidable opposition, and will win many places if not a few firsts, in the races in which it may be entered. So, for those contemplating speed boat work—forget those records in the seventies and make a start !



Mr. Rayman's unfinished single-acting engine for flash steam



A horizontal double-acting steam engine and feed pump by Mr. A. A. Rayman

Bits and Pieces

Some photographs taken at the Exhibition are reproduced here to show some exhibits of interest to power boat enthusiasts. The hydroplane is a very neat Class "D" boat by M. Karslake (Kingsmere) and it was entered in the Competition section. The present trend of hull design is well shown in this boat, and the streamlined appearance is very pleasing.

The engines shown were all exhibited on the M.P.B.A. stand, together with other boats and power plants. Mr. Drayson (N. London), is responsible for the small single-cylinder engine. It is fitted with a piston valve and auxiliary exhaust ports, and bears a superficial resemblance to the "Universal" engine described by "Spectator" before the war. Mr. Drayson is well known as an exponent of the oscillating engine and his boat *Nippy*, so fitted, is often seen at regattas. The new engine will be fitted in a boat for next season, and it will be interesting to see how it performs.

Both of the other engines are the work of Mr. A. Rayman (Blackheath). They are unfinished, but the workmanship is really first class, and both engines are examples of ingenious design.

The vertical engine is intended to provide the motive power for a flash steamer. Certain mechanical failures in earlier engines has led Mr. Rayman to design an engine that is very sturdy without being too heavy. Crankshaft and pump shaft are both on ball-races and are very stiff and strong. It is intended to use poppet valves for inlet and exhaust, and uniflow ports for additional exhaust are cut in the cylinder walls.

The horizontal engine is also designed for flash steam, but of the low pressure variety. The engine is laid down flat in order to get a low c.g. and low headroom. A double-acting slide-valve cylinder is used and gears for water-pump drive are totally enclosed. An oscillating oil pump of the "L.B.S.C." pattern is contained in the oil box on top of the crank-case. A compartment is made in this box for lighter oil for gravity lubrication to bearings, etc. Both of these engines are long term projects, a little work being done to them when time is available, but from the results to date there is little doubt that they will be very fine engines when completed.

A New Zealand Enthusiast

An interested onlooker at a recent Victoria M.S.C. regatta was Mr. W. M. Angus, of Dunedin, New Zealand, who with his good lady is on a visit to Britain. Mr. Angus is a keen speed boat man and has built several engines that have been described in THE MODEL ENGINEER by Edgar T. Westbury, which have proved very successful.

In spite of a cold, raw winter's day, the various events went off well, and some fine runs were seen in the r.t.p. racing. The regatta was a closed event, open only to Victoria M.S.C. members, but a good attendance of competitors and friends made the occasion a very pleasant one. Mr. Angus took many cine-camera shots of various boats, etc., and the film will provide an interesting souvenir of power boating to take back to New Zealand.

At the conclusion of the regatta, Mr. and Mrs. Angus were persuaded to officiate at the prize giving, which took place in the somewhat cramped situation of the boat house. In a humorous little speech, Mr. Angus expressed his enjoyment of the day's sport and observed that although speeds were higher than in New Zealand, he noted that primitive starting methods were still in vogue; also, that he had not learnt anything new in the way of language to assist in starting engines!

TWIN SISTERS

(Continued from page 67)

time in the series, there had not been a single one. Towards the end of the job, things were so well tied up that it was almost like assembling a jig-saw puzzle.

The credit for this is due in no small measure to my faithful drawing board. To me it is an actual part of the machine shop where I can "make" bits and pieces, and try them out without wasting time and good metal. How anyone can bring themselves to despise the drawing board, is beyond my imagination. When I was setting out the valve-gear for the engine, so confident was I in the geometry obtained, that I made all the parts to the advertised centres, ignoring the advice given to make up slotted, expanding links to allow for possible errors.

The finished parts just slid into position, and it was hardly necessary to time the valves. I did, in fact, put some air on the chassis *before* getting down to real valve setting, and she ran in both directions with not a great deal of irregularity.

(To be continued)

A TOOL-TRAY FOR THE LATHE

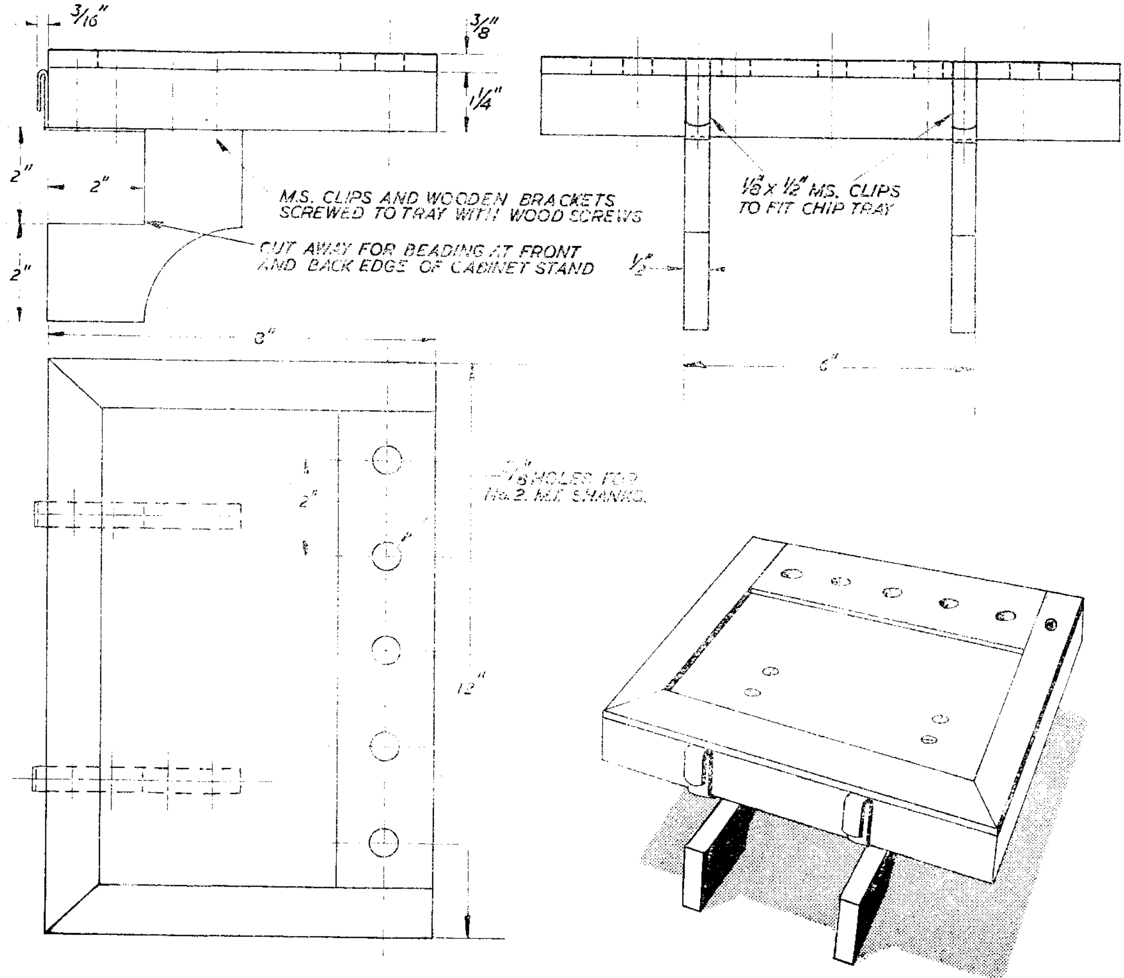
By R. Mawston

WHEN working on my lathe—an "ML7" on cabinet stand with chip tray—I experienced the usual tendency to put tools, centres, chuck keys, etc., in the chip-tray, only to find that when required again they were covered with swarf or more tools. I have even searched high and low for a chuck key which was right under my nose, mixed up with other tools. In order to avoid this annoyance, and also to protect the tools from accidental damage, I designed and made the tool-tray shown in the sketches which, I hope, are self-explanatory, but I may add the following notes :—

The size is that of the ends of a corned beef box. (The brackets were made from the other end of the same box.) In oily situations, lino can be kept cleaner than soft wood, so a small left-over piece was used to cover the wood. The tray was edged with a strip of wood cut from the sides of the corned beef box, one edging-piece being wider than the others to accommodate the $\frac{7}{8}$-in. holes which hold the lathe centres and other tools with M.T. shanks. The chuck keys are held in clips along the back edge. The remaining space is used for cutting tools in a stand and incidentals, such as a micrometer.

The tool-tray normally stays clipped behind the lathe, but can be placed anywhere round the edge of the chip tray should another position be handier for any particular job. If working seated on a stool, for instance, it is useful to have it on one's right hand.

One could fit clips to the workshop walls near the benches to accommodate similar tool-trays, and so avoid the troublesome business of working under a heap of tools when doing woodwork, or when filing at the vice, etc. In the one-man workshop, one such tray with clips near each machine or bench would be all that need be necessary.



A SCALE MODEL BICYCLE

By A. D. Roles

AFTER a long period of studying, I began to look around for a good subject for model-making, by way of a complete change. I wanted to make something unusual, and reasonably difficult—most modellers must have had that feeling—and yet lack of equipment prohibited anything too complicated. A hand-drill, vice, and various small tools were all I had.

I decided that a model of a humble pushbike would be admirable. The scale was to be $\frac{1}{8}$ in. full size, which meant that the wheels would be about 3 in. diameter. These seemed to be the most difficult parts, and it was the wheels that I attempted first.

Wheels

A strip of tinplate, about 10 in. × $\frac{1}{4}$ in. was cut, and, although already tinned, a thicker coating of solder was applied by dipping. This was to be the final finish, as I decided that chromium plating of these and other smaller parts was too expensive, and would take a lot of time. (Also, the only neat way of fixing the various parts of the model together seemed to be by soldering, so that aluminium or stainless-steel were out of the question.) The spoke-holes were made, using a fine punch made from hardened 16 s.w.g. steel wire; only the extreme point was allowed to penetrate, to give a hole just large enough for the fuse-wire spokes.

Next, male and female dies were made from 16 s.w.g. steel plate, riveted together as shown in Fig. 1. The dies were made to the correct cross-section and curvature of the rim. Forming of the rims was quite straightforward, and the joints were soldered so as to be almost invisible. Hubs were now made from tinplate, bent up and soldered, and punched for the spokes.

Spokes

Rims and hubs were then held concentrically in a jig, whilst the spokes were inserted. A tiny "hook" was made at the hub end of each fuse-wire spoke, and the spoke threaded through, as on a real bicycle. Each spoke was tensioned slightly with tweezers, and bent over inside the rim. The correct sequence was followed, around the rim, to prevent distortion when the wheels were removed from the jigs.

After a few attempts to make realistic rubber tyres, I finally laminated these up from hardwood, and carved the tread pattern! Tyres were painted a dull black and assembled on the wheels. The valves were made from fuse wire and soldered from inside the rims, before the tyres were put on. The resulting wheels were amazingly stiff, and quite realistic.

Frame and Mudguards

The frame was made from soft-iron nails of correct diameters: joints were made by applying a generous fillet of solder, and then filing off to a smooth curve. The forks and rear down-tubes had to be filed to a taper, of course.

Mudguards were made in the same way as the wheel-rims, i.e., by making up dies of the requisite section, and "tin-bashing" the tin-plate strips. The edges of the mudguards are turned over, as in the real job.

Frame and mudguards were finished with primer and cellulose, and rubbed down to gain a high lustre.

Chain and Chain Wheel

I had to put in a great deal of thought and experiment before I was able to produce a realistic chain, as each link was less than $\frac{1}{16}$ in. long. Of course, making each link separately was impossible, but the final method adopted was to "plait" fuse-wire in a continuous "figure of eight," for each side of the chain. The rollers were then made by pushing short pieces of tinned copper wire through each loop, as shown in Fig. 2. The whole was then sweated together, using only flux and a hot iron, as there was sufficient tinning on the

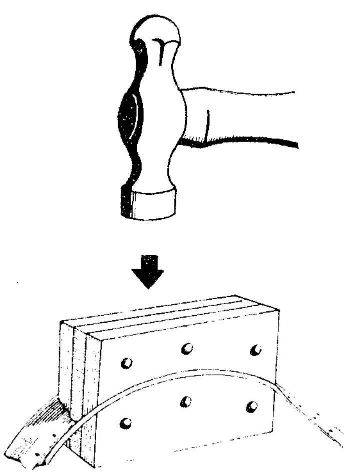


Fig. 1

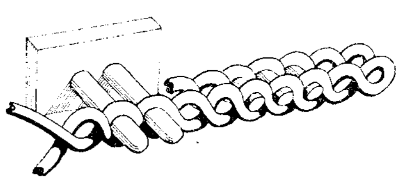


Fig. 2

fuse-wire to hold each "link." The surplus ends of the rollers were then filed carefully off. The chain-wheel was made from a thin sheet of aluminium, cut out by means of a small cold-chisel formed from 16 s.w.g. steel wire. Teeth were cut with a fine triangular file.

Saddle

A wooden former was first carved to the necessary shape. This former was then used as a "press-tool," in conjunction with a vice and a block of rubber, so that the shape of the saddle was imparted to a thin sheet of aluminium. This was then covered with very thin leather, using Bostik to stick the leather on. Springs were made from fine piano-wire.

Miscellaneous

Although most of the major components were finished, much delicate work was needed, with the aid of tweezers, fuse wire, thin aluminium sheet, etc., to produce the many small details

The pump is detachable, and may be "pumped" up and down; brake and gear-control cables are of fuse-wire wrapped around a central strand of steel wire; the bell lever operates (but no sound emerges !); caliper brake assemblies are complete with minute steel springs; lastly, a pair of trouser-clips may be seen dangling from the handle-bars.

The model took roughly 150 hours to build, and provided many problems and much amusement, although its small size makes it rather flimsy.

A somewhat larger model would be a good idea in many ways, and it would then be easier to chromium-plate the bright parts. Perhaps the idea would appeal to other modellers.

(*Editorial Note* : We recall seeing, a few years ago, a very nice model bicycle, made to $\frac{1}{4}$ full-size, at an exhibition in High Wycombe. Subsequently, it was entered in the "M.E." Exhibition and gained a high award.

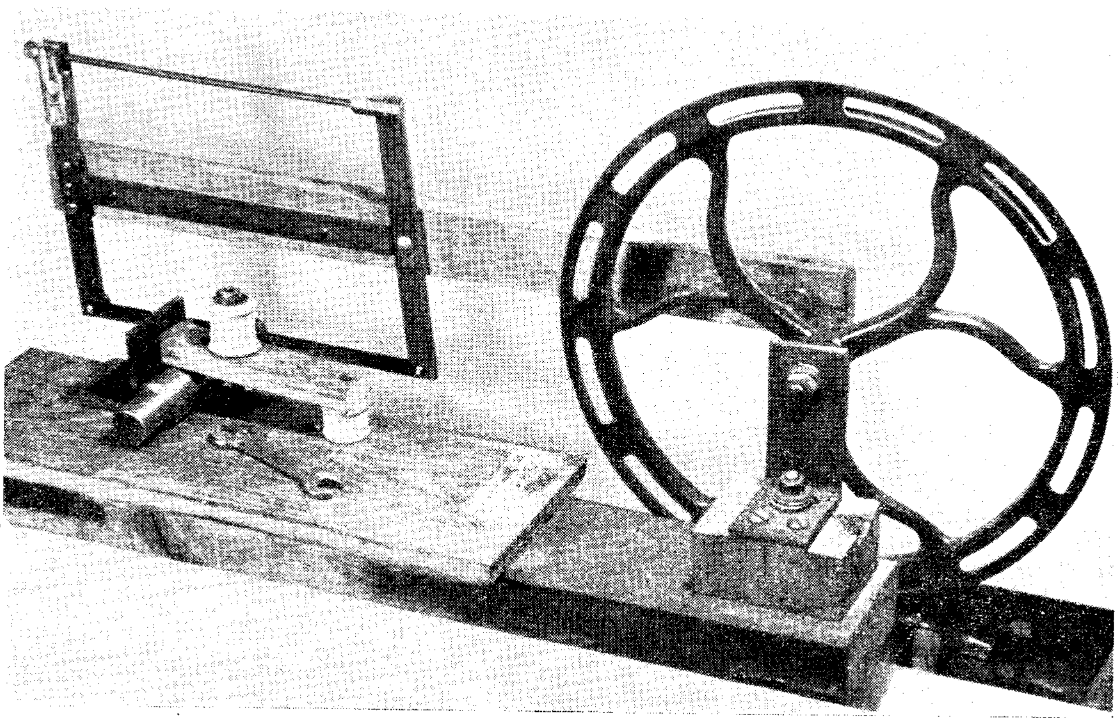
A SIMPLE POWER HACKSAW

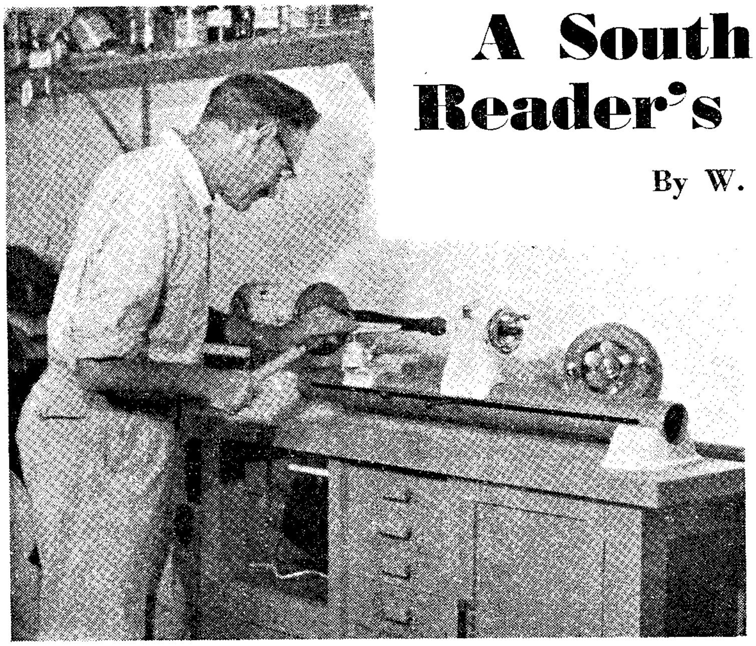
By G. R. Phillips

HERE is a photograph of a tool which can be built in an hour or so at very small cost, and will do all that a power hacksaw ought to do. It is light and can be hung on a nail in the wall out of the way. It consists of a sewing machine wheel mounted on a base of wood, and a wooden beam carrying a frame for a 10-in. hand hacksaw blade. Just below the surface of the base is a $1\frac{1}{2}$ in. steel roller to support the saw on completion of cut. From the forward blade holding-screw, a weight up to 8 lb. is slung by a 2 ft. 0 in. length of cord. In action this weight remains stationary, except for a small up and down motion. The base is fixed in front of a countershaft so that the saw end projects clear over the floor. A $\frac{3}{16}$ in. round leather belt crossed for better grip of the small pulley transmits the power.

At 100 strokes per minute with a new saw and 8 lb. pressure, a 2 in. round mild-steel bar can be cut through in 40 min.

This saw, with its continuous change of angle, cuts with two or three teeth only at a time, so may have some advantage over the flat stroke at the same pressure.



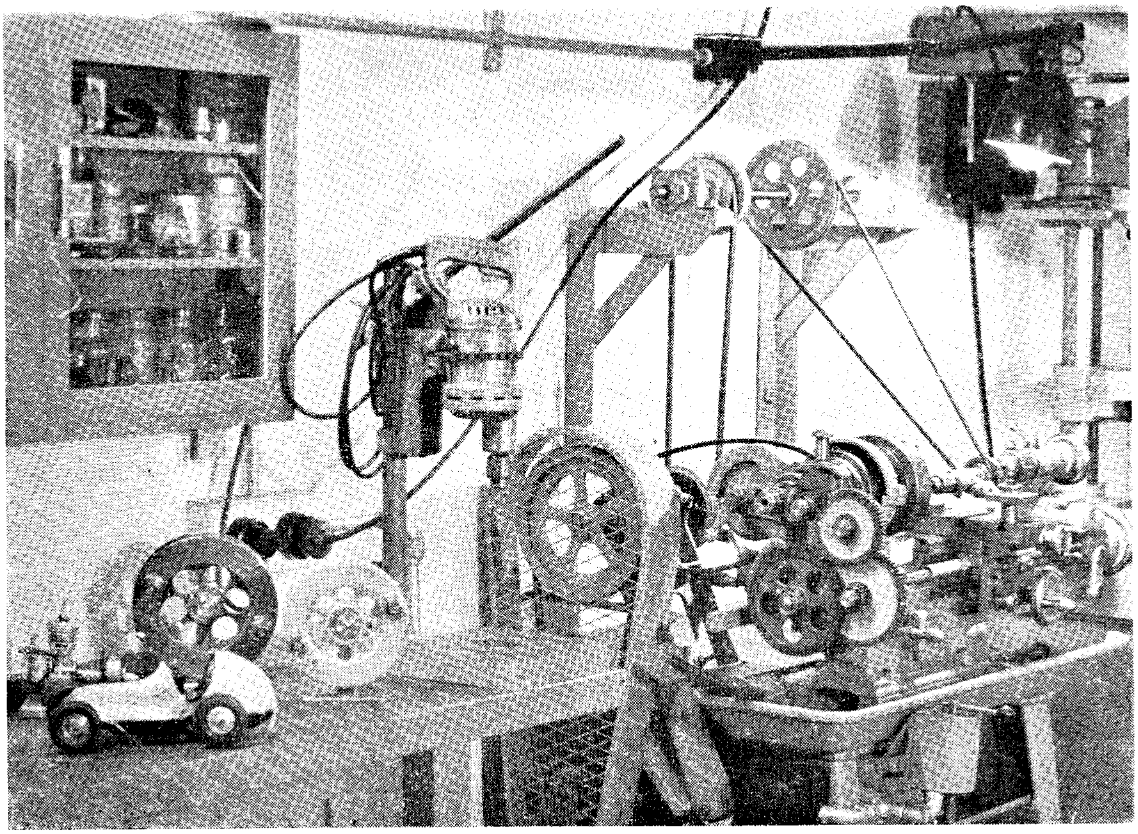


A South African Reader's Workshop

By W. S. Black

LIVING in England when the war began to show definite signs of drawing to a close, I made plans to build a separate workshop, after much planning to incorporate materials available. Space was limited, so the results of my efforts with level and trowel eventually took the form of a building 10 ft. by 7 ft. with a bench running the full length and a good window, plenty of electric points, and central heating for the winter nights and to protect machines and tools from rust.

Next came the big event, the arrival of a Myford "M" lathe, and now I got to work on a 10 c.c. engine and car chassis, also a 5 c.c. engine for my son's plane.



A corner of the workshop showing the "M" type lathe and other equipment

With the housing of a Pultra lathe for a friend, also the usual grinder and small drill press, it was soon found that the shop was becoming over-crowded. So in 1948, when I came to Natal, I was very pleased when I was able to get a small house with a big garage.

When the day came to unpack my equipment and tools I was as excited as a kid with a new toy—six months seemed a long time to be parted from my beloved tools.

The new workshop measured 18 ft. × 11 ft., and looked very roomy after the previous shop. The lathe was re-assembled and wired up. For a week or so the machine packing case made a substitute for a bench, then the main frames and top for the permanent bench were erected, an 8-in. circular saw was now added and I really went ahead fitting cupboards and drawers to the bench. The packing case had now become the base for the circular saw, so the next job was a "pukka" stand for the saw, containing a cupboard for spares, and receptacle for saw-dust. (The packing case now functioned as a cupboard.) As a safety measure, the switch is mounted near the motor, but a push-rod runs through to the front for easy and quick control.

My circular saw made it an easy job to fit up a cupboard stand for the 6-in. grinder, and ½-in. drill press; from the photograph you will see that, at a later date, drawers were fitted in place of the cupboard. This gave me plenty of space for laying out tools under cover, a great time saver, and tools can be kept bright and clean with little trouble.

At this stage I might mention that I have two sons who both show an interest in the use of tools, so to keep the pot boiling, we acquired an "M.L.8" wood-turning lathe which also functions as a disc sander and polishing head. Of course, this involved the making of another bench cabinet, with more drawers and cupboards, but by this time there was no room for the car. Fortunately, we were able to arrange for its accommodation at a near neighbours. The packing case, having served us well, was now made to serve as a hen house.

I cannot claim to have built any very intricate models or wonderful jobs carried out with only a few old files and breast drill, but I've had a lot of fun planning and fitting up my two workshops.

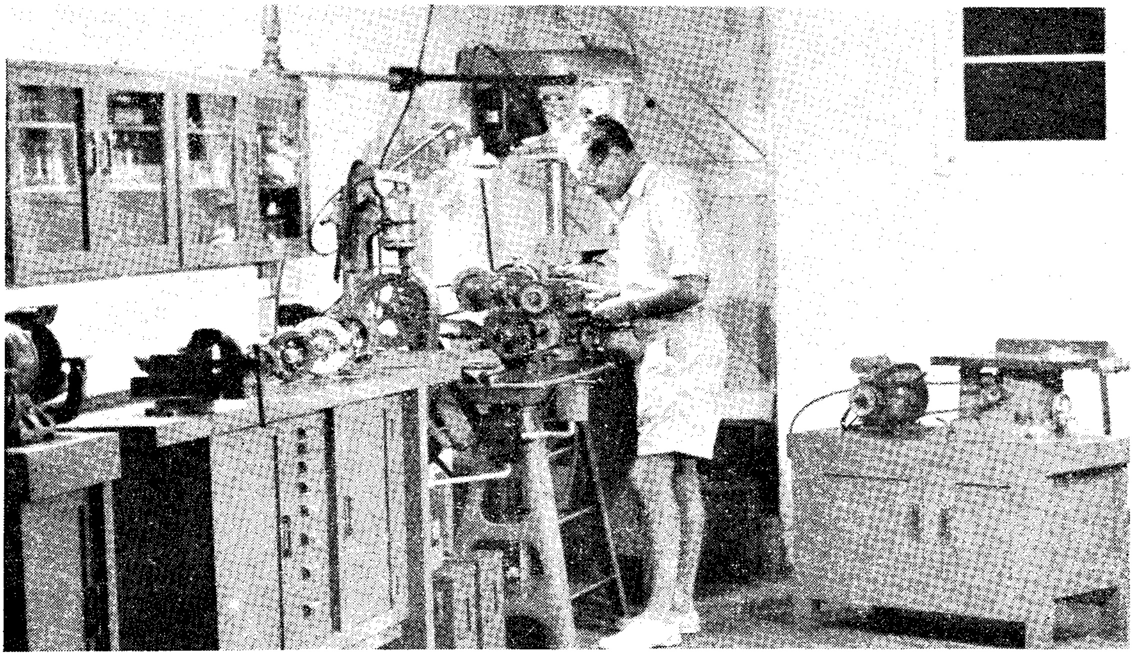
Wood turning gives me a big kick; like the potter at his wheel, you feel that you are really practising at one of the arts.

I have made a contact printer and a large range of fishing reels from 3¾ in. to 7¼ in. for special purposes, for river and lagoon fishing to shark and kite fishing, holding upwards of 1,000 yd. of line, but that's another story. Some may say I've quite a few tools, but you should see my ever increasing piles of "M.E.'s"

Some readers may be interested in the "overhead" drive I have fitted up for milling and grinding. This is done by replacing the counter-shaft with one 3 in. longer, and fitting a suitable driving pulley.

In my own case, I use a pair of 4-step pulleys which give me a very wide speed range when used in conjunction with the two speed motor/countershaft drive fitted to the lathe.

The brackets are made from 2 in. × 2 in. × ¼ in. angle iron bent and welded, finished size 11 in. × 18 in., with a cross brace welded on; any suitable plummer blocks will do. I used S.K.F. S505 ball-races. The shaft is ¾ in. dia. by 2 in.-3 in., the large pulley (9 in.) shown in the photograph is a Myford product for standard ½ in. vee belt, driving from lathe counter-shaft, while the final drive is ⅜ in. leather. No arrangement is shown for adjustment, as the belt happened to be correct for the job in hand when the photograph was taken, but the usual single and double jockey pulley arrangements are in general use with a counter-poise weight when required.



Another view, including the motorised saw bench

In the Workshop...

NOTES ON USING THE HACKSAW MACHINE

BY DUPLEX

SINCE a description was given in this journal of the construction of a small, power-driven hacksaw, it appears that many of these machines have been built by readers, and they seem well-pleased with the ease of construction and with the results obtained in use. As we have had these machines in operation in our own workshops for the past two years, some practical experience gained in working the machine may, perhaps, be of interest to readers.

Saw Blades

For all general work, the Eclipse high-speed steel, 9-in. blade, cut down to fit the saw frame, has fully justified its original cost, for these blades seem to last almost indefinitely without losing their set or tooth sharpness. This is, no doubt, due in part to the accurate guidance given to the saw frame, as the blade is not wracked or worked unevenly, as so often happens when sawing by hand. When making the initial experiments to find the most suitable type of blade to adopt for the machine, it was found that an ordinary carbon-steel blade became blunted much sooner than one of the high-speed steel variety; this was probably the result, to some extent, of not providing mechanically-actuated relief on the idle stroke.

When a carbon-steel blade loses some of its sharpness and set, the material may be cut less cleanly and not so accurately, for the blade then has a tendency to wander if the teeth are worn unevenly; but so far, no amount of work has reduced a high-speed steel blade to this condition.

For finer work, the Eclipse Junior blade was originally used, and the frame is designed to hold these saws. When this type of blade is fitted, the loading must be reduced by sliding the weight backwards along its shaft, otherwise the excessive lead is almost sure to cause the blade to bow upwards.

Recently we have tried the Eclipse jig-saw blades, which are manufactured in a wide range of widths, thicknesses, and tooth pitches. The $\frac{1}{4}$-in. wide blade, having 32 teeth to the inch, has a thickness of 0.022 in., whereas the junior blade is only 0.015 in. thick; the heavier gauge of the former blade makes for greater rigidity, and allows increased loading without danger of bowing the saw or distorting it while cutting. Moreover, in the jig-saw blade the teeth are set alternately, and not as in the junior blade where the wavy form of setting is used: the closer setting appears to give cleaner cutting in the machine, and there seems to be less tendency for the saw to wander when cutting thin material. The blade clamps of the saw frame are made to hold the junior blade in which the distance between the mounting pins is $5\frac{3}{4}$ in.; but as the jig-saw blades are 6 in. between pin centres, a small adapter, of the kind illustrated in Fig. 1, will be needed when the longer blades are used in the machine.

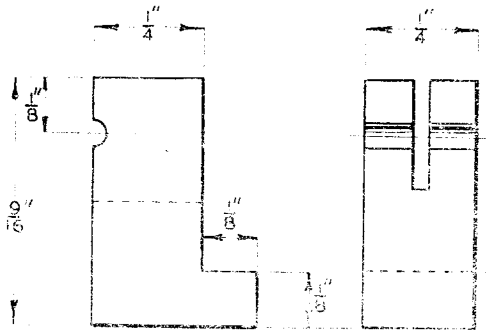
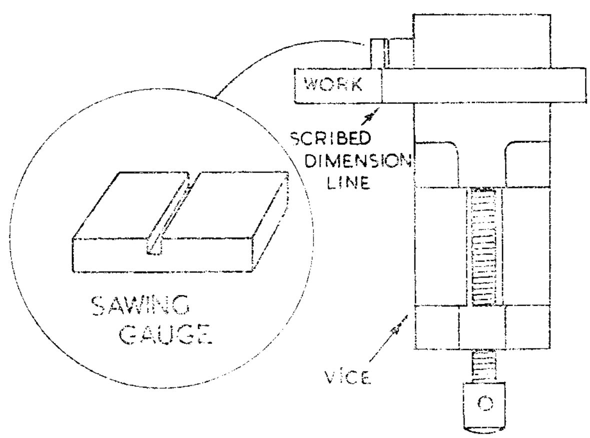


Fig. 1. The jig-saw blade adapter



Right—Fig. 2. Showing the sawing gauge used to set the work in the vice

A Gauge for Setting the Work

When cutting off material, it may eventually save time if the part is severed exactly at a marked dimension line, for the saw should cut the material perfectly square so that only light filing is afterwards needed to finish the cut surface. If the setting of the work in the vice is adjusted by a process of trial and error, involving raising and lowering the saw frame, time may be wasted before an accurate setting is obtained. However, a simple gauge can be made to enable the material to be cut with great accuracy, and there should then be no danger of the saw being set to cut on the wrong side of the line. To make the gauge, grip a short length of, say, $\frac{1}{2}$ in. $\times$ $\frac{1}{4}$ in. mild-steel in the saw vice and

allow the saw to make a shallow cut; then scribe a line across the work from the side faces of the vice jaws.

Next, reset the material in the vice and cut it off exactly to the scribed line. If the finished gauge is now held against the vice jaw, as represented in Fig. 2, it will indicate exactly the limits of the cut the saw blade will make, and the workpiece is then adjusted accordingly in the vice.

Holding Awkwardly-Shaped Work

It may happen that the workpiece is so shaped that it cannot be gripped in the vice in the normal way. For example, a short length of material has to be slit to enable it to be closed by clamp-screws in order to grip a shaft.

The part illustrated in Fig. 3, when held in the vice, could not be brought under the saw blade in the ordinary way, and this necessitated turning the vice on its pivot through an angle of 90 deg. The work can now be correctly aligned if a packing-piece of the right thickness is placed against the fixed vice jaw. When the saw breaks through into the hollow centre of the work, it may travel too far and damage the lower surface of the bore; this can be prevented either by securing a length of brass rod in the bore, or by supporting the saw beam with the hand towards the finish of the cut.

Additional holes can also be drilled in the bedplate to enable the position of the vice to be altered for angular cutting, for the vice is normally mounted as near to the blade as possible in order to reduce overhang when cross-cutting. When taking mitring cuts, at 45 deg., the work can be set nearer the saw blade if one corner of the fixed vice jaw is machined away to a corresponding angle.

Work too large to be gripped in the machine vice can often be held by clamping it with toolmaker's clamps directly to the bedplate. Another way of dealing with large work is to bolt a piece of flat stock, some $\frac{1}{4}$ in. in thickness, to the bedplate by making use of the hole for the vice clamp-bolt. The work can then be secured to the projecting end of the bar by means of toolmakers' clamps, as represented in Fig. 4.

Cutting Off Parts to Uniform Length

Where rod or flat material, or even strips of wood, has to be cut into equal lengths, it will often save time if a work-stop is temporarily fitted to the baseplate, as illustrated in Fig. 5. As the workface of the vice lies at a height of $\frac{5}{8}$ in. above the baseplate, the stop should be $\frac{3}{4}$-in. or more in height, and the fixing will be firm enough if a toolmaker's clamp is used to hold the stop in place.

Setting the Machine Vice

As previously mentioned, much unnecessary filing can be avoided if the vice is set so that the work is cut off exactly square. However, the distance between the side of the

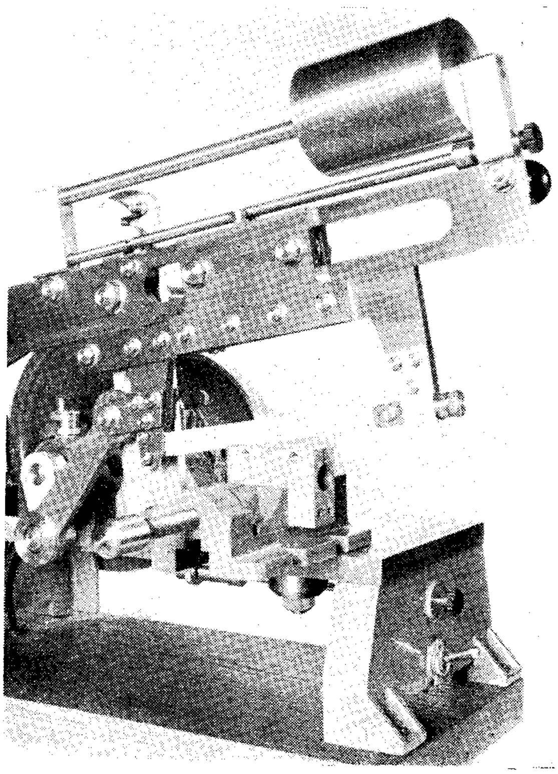
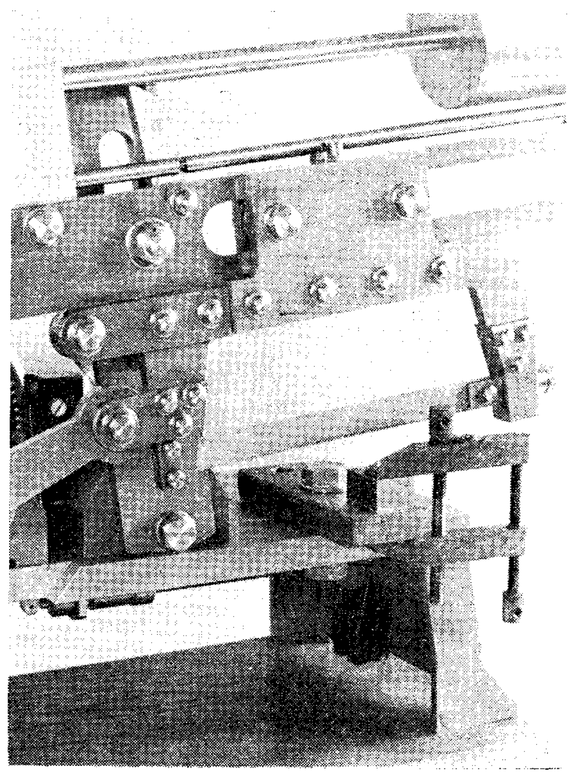


Fig. 3. Position of the vice for slitting a component lengthwise

Below—Fig. 4. Method of clamping irregular work to the baseplate



vice jaws and the saw blade is only $\frac{7}{16}$ in. in width and this does not allow, as one would wish, a try-square of ordinary proportions to be held against the fixed vice jaw and applied to the saw.

To get over this difficulty, a small setting gauge was made in the form of a T-square from two lengths of $\frac{3}{8}$-in. × $\frac{3}{16}$-in. flat, mild-steel, as illustrated in Fig. 6. The stock of the square is cut off some $\frac{1}{2}$ in. longer than the width of the vice jaws, and the blade can be made nearly as long as the saw blade. The two limbs of the square are bolted together with a single pivot-bolt to enable the parts to be securely clamped after the square has been accurately set. To apply the square, the vice clamp-nut is loosened and the stock is lightly clamped in the vice; if the stock is now pushed forward towards the saw, the vice will be truly aligned by the blade of the square pressing against the saw blade. After the vice has been firmly secured, a final check of the alignment should be made.

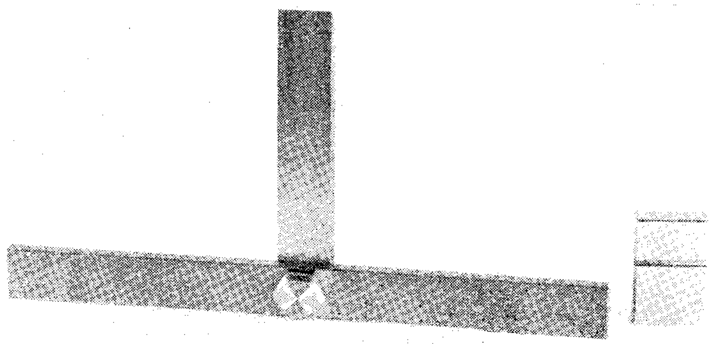


Fig. 6. The square for setting the vice, and the sawing gauge

Operating Hints

When only a short piece is cut off from the end of the work, this fragment may bend downwards, as the saw comes through, and may possibly deflect the blade so that it forms a ridge on the work surface. This can be avoided if the switch is set to stop the saw just before the finish of the cut or, as an alternative, the loose end can be supported with the fingers until it is separated. When starting the saw against a sharp edge on the work, it is advisable to support the beam with the hand, so that only light pressure is applied to the blade, until the teeth have cut a small flat and obtained a longer bearing surface. If the pulley grooves are correctly formed, the belt will grip securely even when run slightly slack; overtightening the belt merely causes unnecessary bearing wear.

Adequate lubrication of all bearing surfaces should be maintained, and it is best to use a thin oil where the bearings are closely fitted. It will be obvious when oil is reaching the crankshaft bearings, but the large pulley should be removed occasionally to make sure that its bearing is well-supplied with oil. Examine the setting of the ball-bearing jockey bracket from time to time and, if necessary, readjust it to take up any tip in the saw guides, but during two years running this adjustment has not been needed. After a time, the meshing of the fabroil pinion may require adjustment to maintain quiet running, and afterwards a little solidified oil should be applied to the gear teeth. The saw slides should be kept well-oiled, and touching the slide surfaces with the finger will show whether the lubrication is adequate. When the machine is new, the crankshaft bearings should be copiously oiled in order to carry away any metal particles detached from the bearing surfaces; if blackened oil exudes it shows that wear is taking place, and this is a sign of poorly fitted bearings.

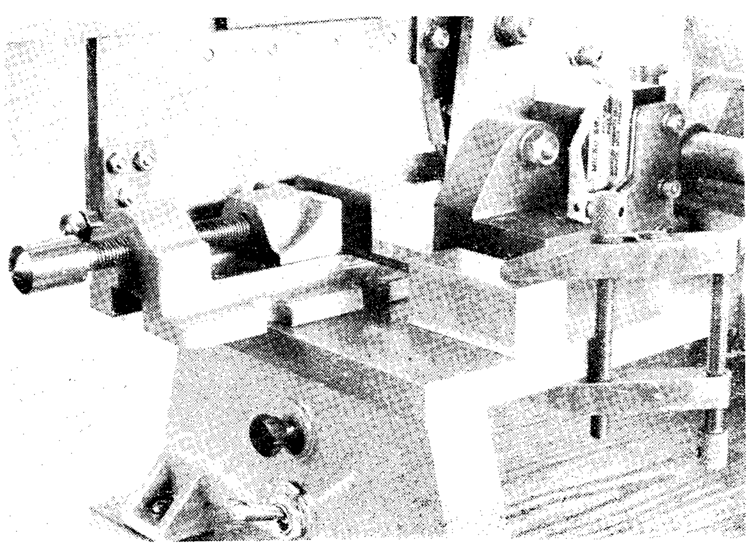


Fig. 5. An improvised work-stop secured to the baseplate

The Earthing Connection

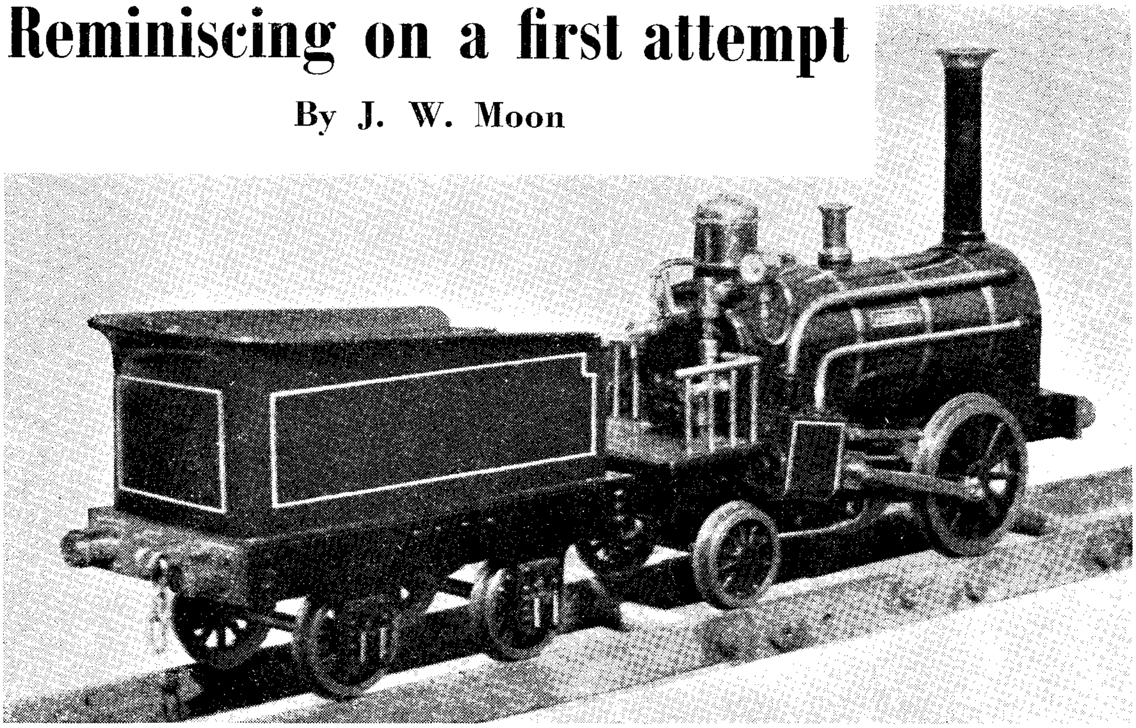
In the interests of safety, the earthing connection should on no account be omitted; for, should a short occur in the wiring, the parts of the machine normally handled may become live and endanger the operator. In the wiring connections originally described, the leads from the mains are taken to a junction box attached to the under side of the wooden base, but if the machine has to be moved about in the workshop, it will be found more convenient if a detachable connector is fitted in the main input leads close to the baseboard.

When making this alteration in the wiring system, the earthing connection must, of course, be retained.

The Goltone, 3-pin, cable connector has the important advantage that the two parts of the fitting can be mated in one position only; this ensures that the positive or live lead is always connected directly to the two switches controlling the motor.

Reminiscing on a first attempt

By J. W. Moon



Mr. Moon's model "Rainhill" locomotive, winner of the Reeves prize at the 1952 *"M.E." Exhibition*

DURING May, 1950, a dream of many years materialised, the acquisition of a lathe. This was one of the old R.B. Drummond lathes complete on stand with treadle drive. The previous owner (my father) purchased the Drummond second-hand in 1943 and had put it to good use in turning the components for a $3\frac{1}{2}$-in. gauge S.R. "Schools" class locomotive. It may be interesting to mention that this locomotive has, during the past four years or so, hauled thousands of passengers on the Tees-side track, a continuous track of 660 ft. In addition, four awards have been gained in North East exhibitions.

It was, therefore, with some feeling of pleasure that the lathe came into my possession for a "mere song," so to speak, my father having purchased a new lathe.

Workshop space presented a problem, being virtually non-existent, equipment for embarking upon a model likewise, and the necessary funds at a low ebb. However, I managed to install the lathe in the only available place, the coalhouse, by first boarding off the coal, leaving a working space of 4 ft. × 4 ft. Due to the absence of a window, a very necessary item was the installation of electric lighting.

Next came a small bench, a $\frac{1}{4}$ in. capacity Goodell Pratt hand drilling machine of 1914 vintage, and a 3-in. vice. Thus, with plenty of enthusiasm and little else, I contemplated embarking upon my very first model.

Period locomotives always intrigued me, and whenever on Darlington railway station I could never resist gazing at *Locomotion No.* 1, conjuring up visions of a period model.

Despite that interest, my knowledge of steam motion was negligible, yet had now reached the stage when I desired to build a miniature steam locomotive.

Being a joiner by trade, using engineering tools was something out of my sphere, which meant a model reasonably simple and, at the same time, not too costly, in view of the prevailing financial situation. During a perusal of some old numbers of THE MODEL ENGINEER, I came across the "words and music" of "L.B.S.C." dealing with *Rainhill*, and there was the solution to my requirements.

Operations in the shape of the frames commenced in August, 1950, bright M.S. 3/32-in. plate being used, much to my subsequent sorrow when lining up the frame, for it was then I discovered that the plate was distorted in all directions due to shearing. The buffer-beams came from some scrap pieces of $\frac{1}{8}$-in. M.S., and all angles from some lengths of material which had previously been riveted to the sides of a discarded dustbin. A small chunk of scrap bearing brass suitably cut into portions with the hacksaw, provided material for axleboxes. By means of a home-made milling cutter, the axlebox flanges were milled in the lathe by setting up each potential axlebox in the tool post. It should be mentioned that the latter process was necessary, due to my not having a vertical slide, an item of equipment, together with an independent chuck, which I still hope to acquire in the not too distant future, when funds permit. Incidentally, the only commercial castings used were the wheels and cylinder castings and the pressure gauge the only finished commercial product, which was second-hand, but given to me gratis.

To achieve the completion of *Rainhill*, all other components were made from all sorts of odds and ends of scrap material. The boiler wrapper was from sheet material, somewhat dented and scored, which proved sound nevertheless, pur-

chased for the sum of 5s. from a fellow modeller. Formers for the boiler were made from a piece of oak, the subsequent silver-soldering process being achieved with borrowed equipment, including a five-pint brazing lamp from my father. All nuts and bolts were made from odd pieces of hexagon rod.

The smokebox front and door came from brass tubing opened out, the tender soleplate from the same source. Sheet copper, which was obtained cheaply, provided the tender sides, but brass would have been preferred had it been obtainable, in view of the copper denting more easily. The coal-space, however, did take shape from the remains of an old brass receptacle formerly used, I believe, for pipe lighters.

In adhering to the policy of making every possible item of *Rainhill* my own workmanship, the making of the nameplates may be of interest. Each nameplate consists of ten separate pieces and each letter was cut out after marking with a scriber, then filed to shape with needle files the letter being held in a pin vice whilst filing. A frame was cut out and silver-soldered to a base, then the letters placed in the frame and likewise silver-soldered. Although not up to the standard of a commercial engraved nameplate, the satisfaction derived from the result of having managed myself, amply repaid me for the time spent on the job.

The ashpan and grate were built to *Tich* instructions, apart from adjusting the measurements to suit. The grate was constructed by cutting up a piece of m.s. plate into strips, then filing each piece to size. Spacers were made from rod drilled through and parted off. *Tich* "words and music" were often perused and were of great assistance during the construction of *Rainhill*.

A piece of lignum vitae provided the material for buffers and proved good stuff to turn in the lathe.

Planking for the footplate came from a cigar-box lid, the planks being represented by scribing lines into the wood prior to fixing. Stirrups on the tender were each made up from three separate pieces of brass silver-soldered together, the material coming from a buckle on an *ex*-W.D. respirator strap.

Silver-soldering small jobs with a one-pint brazing lamp presented something of a problem, due to the absence of gas—all heating being by electricity, apart from the domestic coal fire. Calor gas will, of course, provide the answer when ambitions of a properly equipped workshop are realised.

Boiler testing was carried out under the critical eye of my father, a keen steam enthusiast himself in addition to being one of "the old school" of locomotive drivers whom "L.B.S.C." often refers to with nostalgic memories. The results proved excellent, tested to 150 lb. with air and 200 lb. with water, and compelled me to muse upon whether there was such a thing as "beginners' luck" after all. The boiler-making business from my point of view involved the most difficult part of the construction, but was thoroughly enjoyed.

Bench tests with the locomotive driving wheels jacked up also proved successful at the first time of asking, apart from one leak between the steam pipe and steam chest cover on one cylinder. This test was a great thrill to me, seeing *Rainhill* performing under live steam for the first time. It was, therefore, a great day in July, 1951, when the first run on the Tees-side track was actually going to take place. A passenger-carrying bogie weighing 60 lb. was coupled up when *Rainhill* commenced blowing off and my supreme moment arrived. Somewhat nervously I moved the regulator over (too far and too quickly) the result being a spinning of the driving wheels. More slowly next time and *Rainhill* moved off up the slight incline at that point on the track and away we went completing the 660-ft. lap at the first time of asking. Later, three continuous laps were run off, to be followed by a lap when *Rainhill* pulled both my father and myself, a load totalling over 300 lb. From then on until the end of September, *Rainhill* spent time running on the track.

Nothing can possibly recapture that supreme moment of pleasure when for the first time your own workmanship responds to the regulator, and the thrill of moving along the track behind a real live steam model is attained. All the trials and tribulations of contriving with bits of scrap and working with numbed fingers in a freezing coal house are amply repaid when success is finally achieved. Furthermore, the urge to get on with another more complicated model is given stimulus when the first attempt passes its initial trials.

In October, 1951, *Rainhill* was entered in the Tyneside Society's Exhibition and much to my surprise gained an award, although not yet painted. On its return from Newcastle, a considerable amount of time was spent on painting and enhancing its appearance in general. Came our own Tees-side exhibition, in April, 1952, and a further award, followed by another in May at the Sunderland Society's exhibition.

It is hoped that the foregoing will at least serve to encourage those who, although keen modellers at heart, have, through lack of equipment, workshop facilities and the necessary cash, withheld embarking upon a live steamer. Despite the difficulties encountered on my first attempt, due mainly to circumstances these difficulties seemed to make the job more interesting, and on reflection a better sense of having achieved something on completion.

There is little need to add that any absolute novice following "the words and music" of "L.B.S.C." can rest assured on the results.

Inspiration to build a model no doubt came from my father who is not only a real engineman, but a grand craftsman also; and whilst we of the younger generation have such older craftsmen to follow as an example, then the hobby can not only serve a useful and pleasureable pastime but prove that craftsmanship is not dying out in this present world of mass production. The "lone hand" may be interested to know that half-way through the construction of my first model I was persuaded to join the local society, the Tees-side Society of Model & Experimental Engineers, a step which I shall never regret. The friendship, knowledge and advice gained since taking that step has been invaluable. My regret since has been the fact that I did not become a member sooner and so enjoy the comradeship of fellow-modellers, who ply their craft in a variety of subjects and are unstinting in their help and advice to the newcomer and novice alike.

A NEW REFRIGERATION HANDBOOK

We have received from Mr. Robert C. Scutt, of 52, Hadley Way, Winchmore Hill, London, N.21, a copy of his book *Construct your Own Refrigerator*, which is fully illustrated and contains much practical information. It begins by explaining the principles of refrigeration apparatus, following this up by descriptions of the various types of units available, methods of insulation, cabinets and interior fittings. A special point is made of the possibilities of converting or adapting existing cupboard or larder space; also, the special requirements of caravans and yachts. The book can be obtained from the author at the above address, price 5s. plus postage.

READERS' LETTERS

● Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

SUSSEX PLOUGHING AND ROAD ENGINES

DEAR SIR,—I read with great interest Mr. Greenwood's letter in THE MODEL ENGINEER dated September 11th, also the letter which Dr. Middlemiss wrote about engines down here which he saw during his holiday in this county.

As I live in this area, I thought I would take this opportunity of giving some details of the engines mentioned in these two letters. The ploughing engines which were seen cultivating at the top of Billinghurst Bank, would certainly be two 16 h.p. Fowler compound engines Nos. 15420-1, owned by Mr. Lugg, of Billinghurst. These engines did several good jobs this summer, breaking up some hard ground.

The engine in the showman's yard at Shoreham, is T. Smith & Son's Fowler and her number is 9456.

The engine seen halfway up the Billinghurst bank has now gone from there, but she was a 5 h.p Burrell steam tractor, No. 3807. She is a double-crank compound, carrying fittings for a front-mounted crane, and was used for sawing and small scale soil sterilisation. I had the pleasure of looking after this engine for about 18 months.

The engine at the farm above Pulborough station is a Ransome single-cylinder, No. 17008. The one sawing wood between Midhurst and Petersfield is a Farrell single-cylinder, No. 98, and a very fine engine she is, too. The other two engines on this site were: a Barrett single-cylinder, No. 35461, new in 1931, and the last engine to be made by Barretts; the other was a Clayton & Shuttleworth single-cylinder, No. 33050. All three have now left this site. The Farrell and the Barrett are still very much in being, but I am not quite sure what happened to the Clayton; she was very old and shabby, and I believe she was cut up.

The roller referred to as *Joan* is, I believe, a Burrell, but I am not sure about that. I do not think that the Fowler engine *Supreme*, No. 20223, can be seen from the railway so it must be Messrs. Cole's Burrell, not Foster, Mr. Greenwood saw, as Mr. Polden has since stated in his letter in the October 9th issue.

I am sure that the two engines which Dr. Middlemiss refers to as being up the Billinghurst bank, are, in fact, Mr. Lugg's two traction engines, Burrell single-cylinder 7 h.p No. 2298 and Burrell single-crank compound No. 2770. Also, there is an 8 h.p. Fowler single-cylinder ploughing engine, No. 12366, standing with the two tractions.

As these last three engines are not visible from the railway, I am sure that it was the Burrell, No. 3807, mentioned earlier on, that Mr. Greenwood saw from the "Billingshurst Bank." I hope that neither Mr. Greenwood nor Dr. Middlemiss will think that I am trying to pull their letters to pieces, because that certainly was not my idea; I merely thought it would make it more interesting for everybody to have more details of the engines mentioned in their interesting letters.

Yours faithfully,
Pulborough. G. C. HUDSON.

HOME-MADE IMMERSION HEATERS

DEAR SIR,—Mr. D. May's home-made immersion heater is certainly an ingenious appliance to which he has given a good deal of thought, but I think your readers should be warned that there are several features about it that are undesirable from the point of view of safety.

The only provision made for earthing is to connect one lug of the enclosing tube by means of heavy copper wire to the rising water main. It is very often not realised that quite a high resistance to earth can, in fact, be developed through the ordinary pipe-fitter's joints that are encountered in a system of screwed iron piping, and also that the growing use of non-metallic water mains may mean that what appears to be an earth is, in fact, no earth at all.

The idea of moulding end collars of fireclay cement is not good practice because it is most important to maintain an adequate electrical clearance and insulation thickness, and there will probably be some difficulty in doing this, particularly at the point where the nut and bolt connection occurs. Not only this, but such material has a tendency to break and crumble. Another undesirable feature is that should the element wire break through over-heating or any other cause, and it must be remembered that the element is not working in the situation for which it is designed, it may tend to unwind and come into contact with the copper tube.

Another risk occurs at the point of connection to the two-pin socket outlet. It is very likely that the use of a single strand of nichrome wire will give rise to conditions which will result in a bad contact, and it is practically certain that the temperature will be too high for many of the plastic socket outlets that are available. Bad contacts lead to over-heating and risk of fire.

The method of connection to the mains is not very clear from the article but the use of a socket outlet suggests that the mains will be connected to a two-pin plug which is then plugged into the socket outlet on the end of the immersion heater. If this is done, a disconnection will leave the plug pins alive and unprotected and the use of live plug pins in a lead is, of course, frowned upon in any circumstances.

It is true that the installation of an electric immersion heater in the ordinary way would cost something in the region of £20 but I think it is only fair to point out that this £20 is not saved by merely making up the immersion heater described, as it includes the fitting and the wiring. A commercial immersion heater of the same loading as that described, including purchase tax and without thermostat, costs just over £4.

Nothing is said about insulating the hot water tank, and this may account for the low efficiency shown by the figures. If it takes three to four hours to heat five gallons of water from, say, 50 to 180 deg. F., the efficiency is only about 50 per cent. It is well worthwhile insulating hot water tanks, when immersion heaters are used, with a 3 in. thickness of slag wool, glass silk or granulated cork; it pays handsomely in saving of electricity.

Finally, a word of warning about cutting holes in galvanised iron tanks. Great care should be taken to remove all chippings from the inside of the tank. Such chippings have the steel exposed and this, in conjunction with the zinc coating of the tank, sets

up bi-metallic action and often causes serious pitting of the tank bottom.

Incidentally, the British Electrical Development Association publish a little booklet on electric water heating which can be obtained on application to them at 2, Savoy Hill, London, W.C.2.

Yours faithfully,
London. E. M. ACKERY.

HIGH-TEMPERATURE ELECTRICAL JOINTS

DEAR SIR,—In two recent issues of the "M.E." articles have appeared on the construction of an electric heater.

In both designs there is a similar fault; a connection made with screw, nut, and washers, in a position where a high temperature can be expected.

Such connections rapidly oxidise, form scale, and finally develop arcs which aggravate matters.

One can often see this arcing on the reflector type radiator element ends.

Mr. May, in his article, states as his rêason for making such a connection that the element wire itself is unable to stand up to the temperature inside the tube. Now, the hottest part of the job must be the coil of the element itself, as it is the source of the heat. If that does not deteriorate with the heat a lead of the same material will not.

But joints are always suspect when trouble is around, not only on account of the reasons already mentioned, but because the screws expand, lose their natural elasticity with the temperatures reached, and stay stretched.

I hope this criticism of one fault will not be mistaken as an attack on two otherwise very good designs.

Yours faithfully,
Stockton-on-Tees. R. E. BARKER.

MODEL LOCOMOTIVE SUPER-HEATERS

DEAR SIR,—I have read "L.B.S.C.'s" historical retrospect of this subject with great interest and enjoyment, and I would thank him for his very gracious reference to myself. I am afraid we quite often disagree, but—the respect is mutual.

Now, having been told so much in this interesting article, shall I be considered too curious if I ask for more? Our friend has told us of his first approach when he passed his steam pipe through the single flue, I suppose somewhere in the early 1900s, and we know that in 1922 he used the now usual flues and elements in *Ayesha* and the 4-6-2 tank, as I did in 1919; but he has told us of nothing in between. Is it too much to ask what size of flue and element he used when he first "found it was possible to use several small tubes instead of one large one"? I would add that since my letter of October 16th appeared I have heard from Mr. H. J. Hinks, of Christchurch, that a flue-tube element for a 3½-in. scale locomotive was shown in an article by Mr. Twining of July 1st, 1915.

The matter of cylinder design is, of course, incidental, and I only brought it in to connect things up, the expression "Mr. Greenly's all-circular cylinders" was "L.B.S.C.'s" own, from his letter to the "M.E." of May 4th, 1922; I would also add that the description and drawing of Greenly's "simple" Midland compound, in which the circular spigot was shown and which was produced by Messrs. Bassett-Lowke, appeared in the "M.E." issue of September 1st, 1903, and that the Averill design appeared in the March 15th, 1928, number. Was Mr. Averill's first application prior to 1903?

The Smithies boiler dates back to about 1902; it was described during that year, and did include a quite efficient superheater, a thing for which the multi-tube locomotive boiler would have to wait quite a long time. But during 1903, however, single-flue locomotive boilers in which the steam pipes were passed through the flue were mentioned twice in the "M.E.", the first in April, an actual ½-in. scale locomotive in which the steam pipe passed from the backhead forwards through the flue 1⅛ in. dia., and the second in October in a "Queries and Replies" design, this having a complete loop in the D-shaped flue.

I do not think I started operations so early as "L.B.S.C.", but by about 1904 I had decided to set up a ¾-in. scale railway, and in order to quickly get something to work, I used such bits and pieces as I had to make a much underscale single-cylinder tank locomotive; this really worked quite well and would pull myself perched on the chassis of a proper ¾-in. scale machine that unfortunately never got finished, as on going to Swindon in 1909, interest in model making declined and I did not take it up again until I left the Army in 1916, when a fresh start had to be made.

My first locomotive was the spirit-fired 4-4-2 that "L.B.S.C." mentions having seen at the Caxton Hall, although then not in its original condition. That was the only time it was there; I had taken it up to show that a ½-in. scale spirit-fired locomotive could pull a live passenger, which it did easily. I also remember the occasion, the only one, when my 4-4-0, No. 3, was run on the circular track, because quite a number of engines were being run that night and the straight track was occupied. My recollection is that this occasion was earlier than that of the spirit-fired locomotive. At that time, No. 3 certainly did have a 5/64 in. blast nozzle; passenger hauling was not thought of when it was made, but the nozzle was enlarged as soon as it was used regularly on this, and during the 1920s, this machine was run a great number of times at the Caxton Hall on the passenger track and also at one of the "M.E." Exhibition. It is curious that "L.B.S.C." mentions this about blast nozzles, as I think, on the whole, the sizes I fit are considerably larger than those of our friend.

I hardly think that the single-flue boilers can be brought into this discussion about superheaters. I was concerned with the use, in model locomotive boilers, of the flue-tube superheater as used in the full-sized machine, where it was first experimented with about 1906, but only began to come into general use in 1910.

Yours faithfully,
Bexhill-on-Sea. C. M. KEILLER.

SMALL FLASH BOILERS

DEAR SIR,—Referring to a recent article by Mr. Philip Ward and to letters in your issue of December 4th, I think perhaps a likely material for Mr. Ward's purpose would be a Diatomite Insulating Brick made by Messrs. Moler Products Ltd., Hythe Works, Colchester, Essex.

These bricks are made in a number of standard sizes but they can very readily be cut or drilled to provide any shape required.

The two grades most likely to be of interest are as follows:—

Solid grade, with maximum hot face temperature 900 deg. C., crushing strength 850 lb. per sq. in.

Super H.T. grade, with maximum hot face temperature 1,350 deg. C., crushing strength 800 lb. per sq. in.

I believe the smallest quantity normally supplied is one carton of twenty bricks, and the price for this is about 22s. 6d., carriage paid.

I have no connection or interest in this firm but I do use the solid grade bricks from time to time, and if your contributor has difficulty in obtaining one or two bricks for trial, I shall be pleased to supply his requirements.

Yours faithfully,
Cambridge. A. H. SHILLING.

Draw-bolts for the "M.E." drilling machine

By "Scotia"

THE popularity of the "M.E." drilling machine continues to remain at a very high level, and perhaps it may be helpful to comment on a point concerning it which may prove useful to intending builders.

Whether it is due to carelessness, or being over-zealous, or just plain thoughtlessness, it is difficult to say, but it remains a fact that many model engineers make the common error, when machining the swing arm or headstock casting, of boring out the hole for the pillar first.

They are then faced with the unenviable task of boring out the draw-bolt hole, with the drill constantly running off into the main hole. Often they have to resort to drilling the hole from each side of the casting, in the fervent hope that it will retain enough alignment to pass muster.

Filing Out the Radius

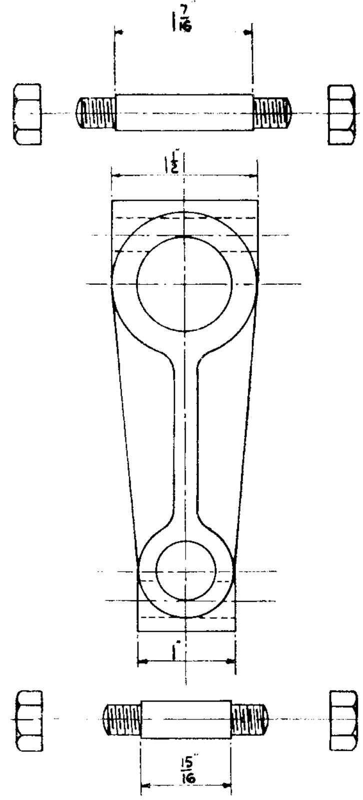
Next comes the almost equally unpleasant job of fitting and filing out the radius on the draw-bolt. Even with the utmost care, it usually just fits where it touches.

All the heartbreak can be cut out, if one follows the correct procedure.

The hole for the draw-bolt, or tangent bolt as it is often called, should be bored out first.

The ideal to aim for is to drill, tool out and ream the hole, at the same time machining the face to about ⅝ in. in diameter, in order to provide a true and correct land for the binding nut. This done, the next step is to bore out the main pillar hole, but before rushing to set it up, let us consider the advantages to be gained by fitting the draw-bolt *in situ* while the large hole is being bored out. I achieved this by making the draw-bolts in the usual way, but adding a short screw to the back end also. (See sketch.) The bolt was inserted in the hole and nutted on each side. Now the work was bolted to the faceplate of the lathe and the pillar hole tooled out carefully to a sliding fit. When removed from the lathe, the draw-bolts were aken out, the extra screw sawn offt and a radius formed.

The result of following out this procedure was a draw-bolt which was a glove-fit on the pillar, and which, when fitted with the handled nut, needs only a touch to tighten securely, with absolutely no bruising of the pillar.



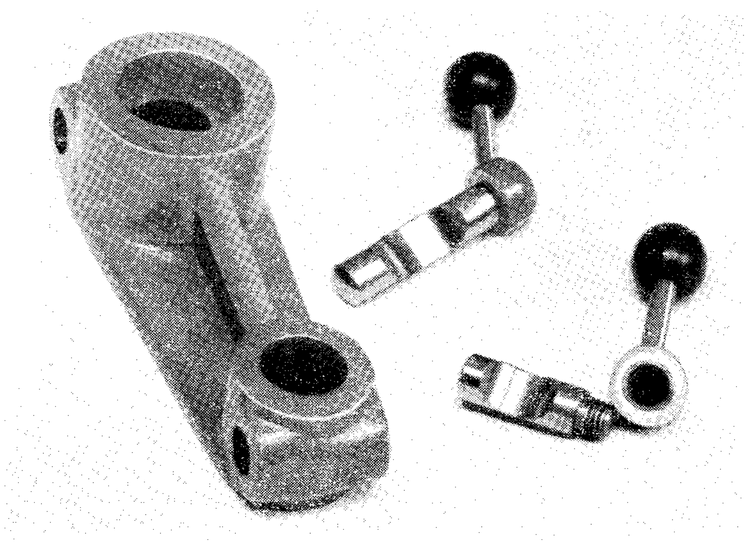
Swing or table-arm—plan view, showing how draw-bolts are screwed each end

Where it is not possible to machine the draw-bolt holes in the lathe, the casting should be securely clamped to the drilling machine table, with due consideration given to correct angle, and carefully drilled and reamed at one setting.

If one is able to spot-face the work in a neat manner, to give a true seating for the nut, this method lacks little, if any, of the advantages of doing it in the lathe. Like most builders of the "M.E." drilling machine, I bronze bushed the headstock bearings, jockey pulleys, and driving spindle bearings.

I am indebted to "Duplex" for helpful data concerning modifications to the drilling machine.

My thanks also to Mr. H. E. S. Chase, for a very informative article which appeared in THE MODEL ENGINEER for July 7th, 1949.

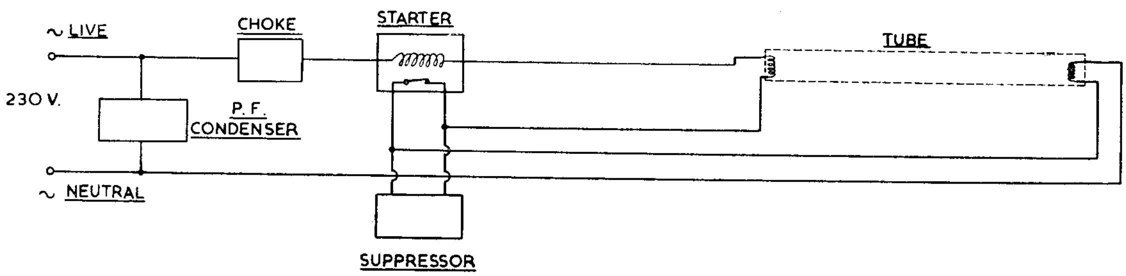


View showing the swing arm and finished draw-bolts

FLUORESCENT LIGHTING IN THE WORKSHOP

By D. E. S. Isle

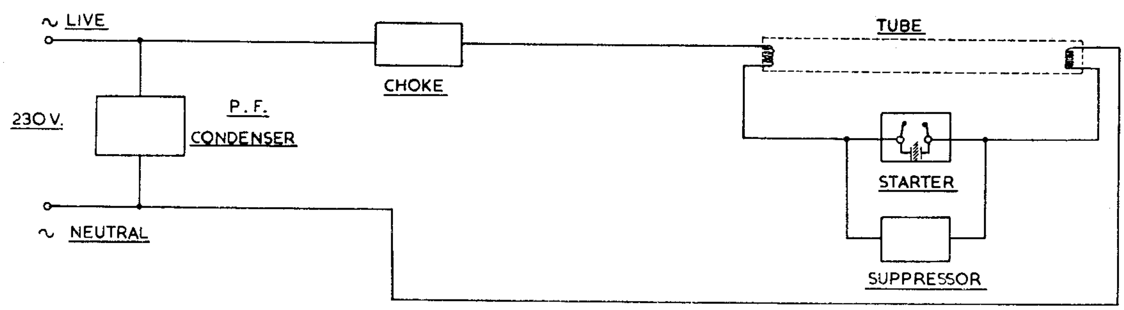
FLUORESCENT lighting is now quite commonplace, but even so, the use of other than the usual filament lamps in the amateur workshop, is not widespread. Consider, that for a current consumption of 80 watts, the fluorescent tube produces a useful light output equal to that of two 100 watt filament



Circuit using thermal starter

bulbs. The initial expense is admittedly greater, but I hope to show that economy will result with judicious use of switching.

The fluorescent tube is a type of discharge tube, in common with the familiar neon signs, and shop lighting strips. But here, the similarity ends, for the fluorescent tube operates at mains voltage across



Circuit using glow starter

its equipment, whereas the display sign tubes require voltages of up to 7,000 V., for efficient operation. Also, if the fluorescent coating were removed from a tube, there would be no visible light at all, as the internal discharge is in the ultra-violet band.

The fluorescent tube is simple to connect, and provided reliable components are used, it should have a useful life of between two and three thousand hours for each tube. It must be stressed here, that it is the starting cycle which is the greatest factor in the depreciation rate of tubes, so, if the tube can be left running, this is often more economical than switching off and on again, repeatedly.

The starting technique is as follows : A starting choke is fitted in the live side of the mains supply, in series with the lamp heaters. Also in the series circuit, is the heater of the thermal starting switch, the contacts of which close the heater circuit. (See diagram.)

On closing the supply switch, the heaters of the tube, and the starter switch, are energised. After 2 to 3 sec., the contacts of the starter switch open and cause an inductive surge voltage across the tube. This voltage is high enough to start the discharge along the length of the tube, but the discharge continues with about 120 volts drop across the tube. The normal working current, passing through the starter switch element, is sufficient to keep the contacts of the switch open, during the running period. When the tube is switched off, the contacts close rapidly, in order that the starting sequence may be repeated.

An alternative starting switch is sometimes used, known as a " glow switch," which is heated by the passage of a current through a semi-conductive gas. The contacts of this type of switch close on operation, and open as the tube commences to ionise. In either method of starting, the tube now is taking its normal current, limited by the impedance of the starting choke.

In laying out the lighting for a workshop, two points must be considered. Firstly, general lighting must be of such an intensity, as not to prove too great a contrast, when moving from a locally lit area. Secondly, filament lighting should supplement fluorescent lighting over moving machinery. Apart from the fact that the conventional machine work lamp is more manoeuvrable, fluorescent tubes on a single phase supply give a decided flicker, which may be observed by looking casually at a surface so illuminated. On rotating work, especially when the speed is a multiple of 50, the work will often appear quite stationary, or slowly

revolving. This effect may be minimised by the addition of a local filament lamp, illuminating the work. Another method of reducing the flicker, and the stroboscopic disadvantages, is to use three tubes in each lighting unit, each tube energised from a separate phase of a 3-phase supply. The flicker rate is now raised to 150 cycles, and therefore the periods of minimum light intensity are much the less noticeable. Stroboscopic effects are still a little apparent, but only at 150 r.p.m., and multiples. The general situation is much less dangerous, as the value of light on the job never falls to the instantaneous zero, which it approaches on a single phase supply.

Fluorescent tubes are not suitable for use on d.c. mains supply; although operation is not impossible, it entails reversing the polarity of the supply to the tube at regular intervals, and a special starting vibrator.

Summarising, it may be said, that with the precautions outlined above, the fluorescent tube lighting unit is an economical unit, and an efficient lighting source for any workshop.

Look around your workshop, is there not a profusion of shadowy corners and brightly spotlighted machines ?

FOR THE BOOKSHELF

West Midland, by Edward Beal. (London : Percival Marshall & Co. Ltd.) Fully illustrated. Price 15s. net.

This book tells the story of one of the best-known "OO"-gauge model railways in the world. For some twenty-five years, Edward Beal's name has been known as that of one of the pioneers of "OO" gauge, and the degree of perfection which Mr. Beal has achieved through constant practical work in this field is an example and inspiration to everybody interested in the subject.

This book tells the story of a remarkable creation, built up as the result of long experience. But it does more than this, because its author gives minute details of the methods he has used in order to produce the results. The book, therefore, is a useful textbook as well as a very interesting and entertaining history, and we would suggest that everyone interested in the model railway hobby at its best should possess a copy.

The Watchmaker's Lathe, and how to use it. By Donald de Carle. (London : N.A.G. Press Ltd.) Price 30s. 155 pages, $8\frac{1}{2}$ in. × $5\frac{1}{2}$ in.

This is another of the highly practical works on horological technique by this prolific author, and it represents the first textbook on the watchmaker's lathe to be published since the beginning of the century. It is clear, therefore, that it fills a definite need, in view of the many developments and improvements which have taken place in lathes and their accessories during this period. Although the basic principles of lathe design, and also their operation, do not change, the particular types of machines used for horological work are highly specialised, and many of the methods employed in operating them differ widely from those employed in general engineering practice. All the lathes in production today, with their special equipment, tools and accessories, are described and illustrated, and advice is given on fixing, mounting and driving them by power, hand, or treadle.

The admirable line drawings, no less than 229 in number, all specially drawn for this book, are as lucid and practical as the text. A minor criticism is that the phrasing of some of the descriptive matter is disjointed, and transgresses the canons of correct English ; but in no case does this confuse the meaning, or make it difficult to follow.

Practical Motorists' Encyclopaedia. By F. J. Camm. 8th (Revised) Edition. (London : George Newnes Ltd.) Price 17s. 6d. 378 pages, 8 in. × $5\frac{1}{4}$ in.

Everything in motor engineering, from acceleration to zirconium, is dealt with in alphabetical order in this book. Whether this manner of approach is the most suitable for describing technical subjects is open to some dispute, but there is no doubt that it makes individual items easy to find, when it is desired to refer to them quickly. The present edition has been revised and brought fully up-to-date with modern practice ; it gives advice on maintenance, overhaul and repair of cars, also tracing troubles. Over 500 line drawings and diagrams are used to illustrate the text.

Britain's Railway Liveries, by E. F. Carter. (London : Burke Publishing Co. Ltd.) 320 pages. One colour chart, eight coloured plates and numerous other illustrations. Price 36s.

It is often a matter of great difficulty to obtain accurate and sufficient details of the colours and styles of decoration of railway locomotives and rolling stock, when we come to paint our model locomotives, coaches, wagons and vans. Among the reasons for this may be mentioned the infrequency with which historians of the past ever thought to mention the subject ; the paucity and unreliability of the information given when it was mentioned, and the impossibility of describing colours in words. This book, however, does a great deal to solve a problem that becomes more difficult with the passage of time.

The contents have been culled from practically every known source of information and arranged under the title of every railway company that has existed in Britain from the earliest times, set out in alphabetical order. Much of the material is redundant and even conflicting, but the author has evidently thought it best to present the data in this way.

The coloured plates well depict the liveries of the locomotives they illustrate ; the photographic reproductions are helpful and interesting, while the numerous other illustrations serve a great variety of purposes inherent to the subject.

So far as we are aware, this book represents the first attempt to collect together between two covers anything like a complete record of our railway liveries. This extremely difficult task has been approached with laudable courage, but the method employed has led to some inconsistencies which, no doubt, will be eliminated in future editions.

TESTING SMALL LOCOMOTIVES

By Charles R. Wilkinson

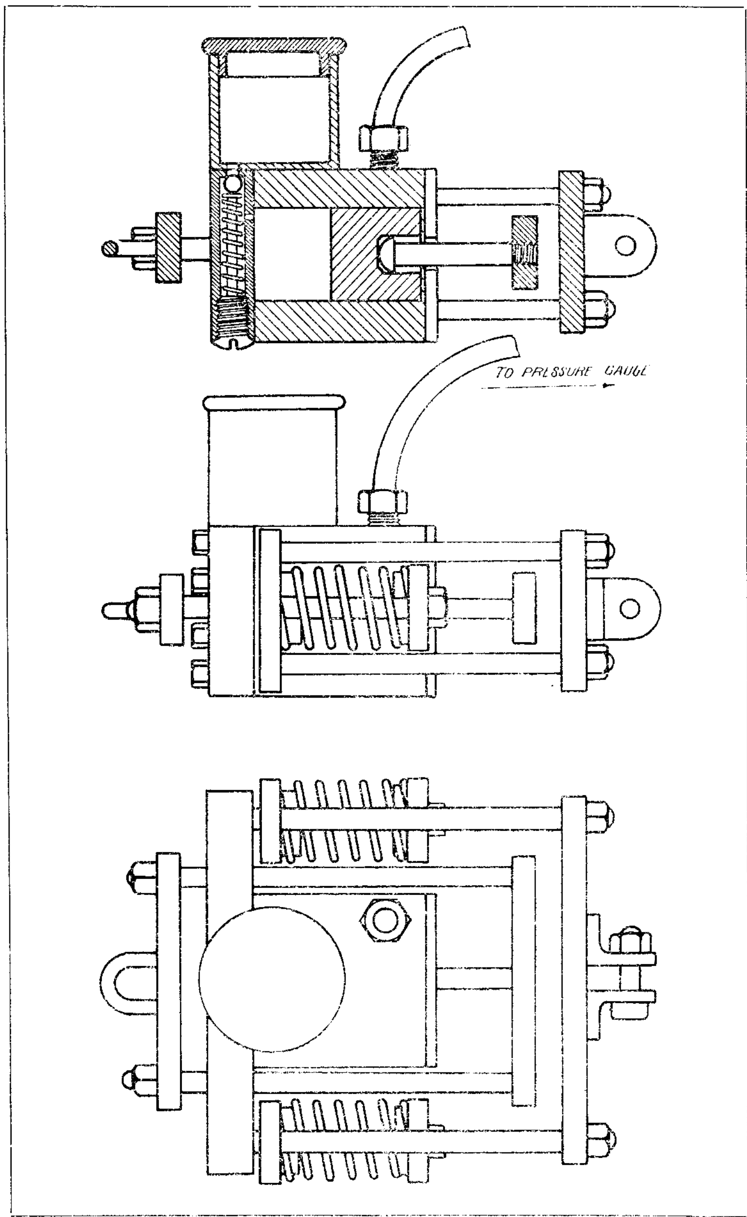
TO find the efficiency of a small locomotive three data are required: the work done, the time taken to do it, and the fuel used. To get the work done, it is necessary to measure the draw-bar pull; there is no other way. Several instruments for this purpose have been described in these pages, and yet we are still getting results of tests in which the load hauled is one of the factors. I wonder why. The fact is, these tests of which we read in THE MODEL ENGINEER are really friendly competitions, interesting, especially to those taking part in them, but none of them up to now has given the brake or draw bar horse power developed.

I made a hydraulic coupling, a drawing of which is given herewith. Nothing novel is claimed for it, there is no invention about it, but as it works very well, I would like to describe it. Its main component is a block of brass about $1\frac{1}{2}$ in. cube, bored centrally $\frac{13}{16}$ in. diameter, and a mild-steel solid piston carefully fitted.

Freedom

There is no piston-rod with stuffing box; it is a push-rod in the back, or open end of the cylinder. Also, there is no packing or cup-leather on the piston; it must be quite free. The front or pressure cover is a piece of mild-steel plate about $\frac{3}{8}$ in. thick, so as to contain the ball valve with its spring, as well as to withstand the strong pull and jerks of a heavy engine. It is held to the cylinder block by eight 4-B.A. studs and nuts. The joint has to stand pressures of up to 200 p.s.i. without leaking. On top is a small reservoir to hold a spare supply of oil, so that, to refill the cylinder, it is only necessary to squeeze the couplings together gently, and the oil will pass the ball valve, this being held up by a very weak spring. The connecting pipe to the pressure-gauge has then to be at the back end of the block. There is plenty of metal at side of bore to drill and tap a hole without breaking in. Of course, a small hole is drilled to it from the pressure end. I thought it advisable to fit two springs, as shown, to soften any jerks, and I also fitted a safety-valve (not shown) in order to protect the gauge. As with 5-in. gaugers, pulls of 90 lb. and over are common, and as, with this piston of half a square inch area, the oil pressure is double the draw-bar pull, I consider a safety-valve necessary.

The springs are car valve springs, as arranged they have no effect on the gauge readings. On testing the coupling in the hut, I found that it sustained a weight of 50 lb. for at least 20 min. before all the oil had leaked past the piston. Now, considering that my workmanship



is not really first class, and that the cylinder holds less than half a cubic inch of oil (I use "3-in-1" oil) that is not too bad. I guess, if the job were up to the standard of Mr Austen-Walton's piston valves, which would not enter the liners when warmed in the hand, the oil would take an hour or two to leak past. Also note that, so long as there is some oil between piston and cover, that is until the piston does actually touch the cover, the gauge registers correctly.

Calibrating

To calibrate the gauge, having first seccotined a bit of white paper over the dial, I made a steelyard, got a clockweight which weighed, with a few washers, 10 lb., some bricks which weigh about $8\frac{3}{4}$ lb. each, and some scrap metal. While struggling with these in the hut, Janette poked her little nose round the door and said, "What are you doing, Grandad?" (I am not her grandad). I thought: Why not weigh Janette? Soon done, the chemist, a few yards up the road, has a new Avery weighing machine. She weighed 51 lb., her elder brother 76 lb., and another bigger lad just 90 lb. A loop for a foot in a bit of light chain, a bit of wood for a hand hold, and the weights were quickly marked on the dial.

Just the Gauge

When looking for a gauge, I found in the list of S.A.M., the Stockport dealers in surplus aircraft material, just the thing, an oil pressure-gauge with about 20 ft. of capillary tubing. The tube has a very tiny bore, and when bought, a brass tag warns you on no account to disconnect or break the tube. I dare say many of you have seen these gauges, and I note, today, they are still available. Gauge and tube are completely filled with a sweet smelling liquid. I am pretty sure that this makes the coupling a success. Having coupled up the gauge and filled the cylinder with thin oil, you know there are no empty spaces in gauge or tube, and the least movement of the piston shows at once on the gauge. Really the piston seems not to move at all; of course, it moves a tiny bit, but only a thou. or two. I had to cut the tube, wanting only about two yards, but the bore is so small that the liquid does not leak out.

My idea for using the coupling is as follows. Supposing an endless or circular track is marked at suitable intervals, not necessarily equal, but having regard to gradients, curves, etc. An observer sitting behind the driver, holds the gauge with its two yards of connecting tube, and at each mark, either writes down the gauge reading, or else has a friend sitting in front of him, to whom he shouts each figure. The average draw-bar pull is thus determined, and the distance run being known and the time taken, the real brake or draw-bar horse power is very easily calculated.

Measuring Steam Consumption

Now may I say that, if possible, the steam consumption of the locomotive should be measured. I suppose the only way to do this is to measure the feed water actually used on the run. Of course, the safety-valves may blow a little to waste, and injector feed raises a bit of a question, or does it? I have not quite summed this bit up. Most tanks have no blow down, but the water could be easily syphoned out, with a syphon having a notch at the end of the short leg, which would leave the last $\frac{1}{8}$ in. of water in each and every tank. A locomotive, is a dual entity, boiler and engine. It is, therefore, surely advisable to find how much steam the engine is using, as well as how much fuel the boiler requires to generate this steam.

[*Editorial Comment.*: This article is the first that we have seen in which the problem of the efficiency of model locomotives has been approached from a modern point of view. In full-size practice, locomotive efficiency is now calculated on the basis of drawbar horsepower developed per pound of fuel burnt per square foot of grate per hour; on miniature tracks, however, the basis generally taken seems to be: the load hauled per certain distance per certain time per pound of fuel burnt, and this does not appear to be quite logical. Mr. Wilkinson presents a new line of thought, and the apparatus he describes would seem to give results that are fair to any locomotive, irrespective of its type or size. Perhaps, some of the owners of continuous tracks may care to make up replicas of Mr. Wilkinson's apparatus and try them out.]

HOW MANY?

A COLLEAGUE has handed us a cutting from the November issue of our American contemporary, *Power*, which contains a letter that reads as follows:

"When I visited a mountaineer friend in Hardy County, West Virginia, recently, he said, 'Young Jim Zirk made him a steam engine. He made the cylinder out of a piece of steering post from an old, junked Buick auto. Flywheel is the big gear from a cream separator. He took two of those cover pieces that go over the differential, and bolted them together for a boiler. He built the engine on a railroad tie for a base. She runs, too,' he added, 'and Jim is only 17.'

"Next day, I looked up Jim Zirk. Soon there was a fire made of wood chips and corncobs. But I felt 'funny' to be getting up steam on a boiler that had no steam or water gauges—and no safety valve. Then she started running, and did better than 150 r.p.m. until she ran out of water.

"Jim had never seen inside an engine, read books, or seen pictures of the project. These mountaineers are smart, considering how little they have to work with. How many steam engineers have the interest to make a model?"

The answer to that question is: Probably more than he thinks, though we believe that this would apply more to Britain than to the U.S.A. Wherever it is, however, the making of a model based on such meagre particulars and out of such extraordinary materials required a degree of pluck and determination that deserve admiration; Jim Zirk can be no ordinary young man!

We can well appreciate that the writer of the quoted letter felt "funny" during the steam-raising stage; we think that our own feelings would have been the same in similar circumstances! But, on reflection, was there any real danger? Those two differential-covers are certain to have had nicely finished surfaces at the joint, and to have been held together by about 10 or 12 bolts. If steam pressure had mounted to bursting point, the probability is that the joint would have become distorted causing a leakage of steam, more or less violent, thereby relieving the pressure before anything really serious could have occurred. All the same, there was an element of risk which a more knowledgeable and prudent experimenter would have hesitated to take, and adds some point to the old adage about fools rushing in!

QUERIES and REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Building a Model "Javelin"

With reference to your Javelin *type destroyer plan, I am not clear about sizes of metal for the frames. Perhaps you could advise me, as I think Tee-section the best. I have built a hull in timber, bread-and-butter, 5 ft. long, and naturally will scale down, but I am doubtful of the safety of wood, as I shall use a centre-flue boiler and blowlamp. I am also doubtful of the buoyancy of a timber hull for the weight, as I think it will be heavier than metal, and so I could use this as the former. Do you think this is wise?*

B.M.J. (Prestatyn).

When we were preparing the *Javelin* plans, the Tee- or angle-section was unobtainable, owing to war requirements. Our suggestion at that time was to use strip about $\frac{3}{8}$ in. wide, reinforcing it by means of a length of wire soldered on to the inside. However, if the material is once more available, we would suggest angle $\frac{1}{4}$ in. × $\frac{1}{4}$ in., or Tee of a similar section as an alternative.

With regard to materials, successful model makers have built their steamers in wood, but the inside of the hull should be protected from heat by asbestos sheeting. Unless you have been able to reduce your hull thickness to approximately $\frac{5}{16}$ in. or $\frac{1}{4}$ in., or alternatively if you have been unable to keep the weight of the wood hull down to something below five or six pounds, it is possible the model might be unstable. In this case you would be well advised to use the hull you have made as a former, and build the hull by the method suggested in the articles on hull construction, published in *Model Ships and Power Boats* for February and March, 1952.

Successful hulls have been built from tinplate with a moderate degree of internal stiffening in the form of ribs and bulkheads. The superstructure also must be kept as light as possible, using either 1/32 in. 3-ply or tinplate. The guns and fittings should be made of light alloy. With the destroyer type of model, great care should be taken to keep the centre of gravity as low as possible, owing to the narrow beam.

Converting a "Bladon" Petrol Blowlamp

I wish to convert a "Bladon" $\frac{1}{2}$-pint petrol blowlamp to run on paraffin as an economy measure. Is this practicable? Details of the lamp are as follows:

(1) *It is fitted with an external pressure pump and spring-loaded non-return valve.*
(2) *It has a screw-operated pricker, and needle control valve controls the nipple outlet.*
(3) *A central fuel wick tube is incorporated in the body, with the filler cap on the base, and an additional filler cap and air release is fitted to the tube of the reservoir.*
(4) *A spring-loaded safety-valve is fitted to the reservoir.*

F.E.G. (Datchet).

It is usually found that the conversion of a petrol blowlamp to run on paraffin is not possible without fairly drastic alteration to the lamp. Owing to the higher temperature of the entire burner, paraffin blowlamps are not usually satisfactory when fitted with a central wick tube, as the upper end of the wick would almost certainly become carbonised. We suggest that the most satisfactory method of converting your lamp would be to remove the entire burner and vaporiser, and fit a standard type of paraffin burner such as that fitted to the Primus or Optimus type paraffin blowlamps.

The reservoir with its pressure pump and spring-loaded safety-valve should be quite suitable for use with the paraffin burner. We have no information available on the dimensions of the nipple and air apertures in the flame tube of these burners.

Design of Current Transformers

I have just bought a Taylor Windsor Universal testmeter, model 75 A, 20,000 hrs. per volt sensitivity, the highest current range of which is 5 A. I wish to extend this a.c. range to 30 A, for which a current transformer is required. I am conversant with the design and building of power transformers, but can find no information on current *transformers for instrument work. Could you advise me of any book which deals with this subject, or failing this, could your electrical experts supply me with the required data for the building of one? Messrs. Taylor Ltd. specify one designed to operate with a 500 MA secondary load, and which extends a.c. current range of meter from 5 A to 10, 25, 50, 100 and 200 A.*

D.B. (Thrupp).

The design of a current transformer follows the same lines as an ordinary transformer so far as amp. turns are concerned. For use in instrument work, however, there are one or two factors to be considered. It is necessary to know the meter characteristics, and this also applies to the particular rectifier used. Without these details, very little could be done. There are no publications dealing especially with instrument transformers, but we would suggest that you communicate with the Westinghouse Brake & Signal Co. Ltd., 82, York Way, N.1. These people publish a book dealing with their rectifiers and also give a design for a current transformer that would suit their particular rectifier, and from this you will be able to get a general idea as to the set-up.

Increasing Beam of Model Vessel

By what yardstick does one increase the beam or draught in a model vessel? I have heard a modeller say that he always added a quarter-of-an-inch to the beam in order to get stability. That, one might say is the result of experience, but surely there is a more definite method in which to arrive at that figure of a quarter-inch.

Perhaps you could suggest a book that covers the point.

M.M.W. (Sunderland).

There is no rule by which one can increase the beam or draught in a model ship to ensure stability. Experienced builders, such as Mr. Norman Ough and Mr. Chapman, seem to be able to build their ships strictly to scale and get them to sail satisfactorily. This, however, is entirely due to the method of hull construction they adopt, which is to use tinplate with a few bulkheads

for strength. The superstructure in their models is also extremely light, and as they favour electric drive they can get their motors and batteries well down below the water-line, and thus ensure stability.

Most builders, however, are not quite so expert and we aways recommend additional beam and draught, as a small increase in these dimensions causes a considerable increase in displacement. With a steam engine of the marine type, the weight of the cylinders is an appreciable distance above the centre-line of the crankshaft, and this raises the centre of gravity. The reason for the popularity of the centre-flue boiler for model steamers is chiefly due to the fact that its centre of gravity is very low. I think, if you will study the articles at present running in our magazine, *Model Ships and Power Boats*, on "Naval Architecture for Models," by F. C. Chapman, keeping in mind the points we have just raised, you will be able to design your models successfully.

There is no book other than the standard works on full-sized ships which deals with this subject.

Case-hardening Materials

Could you please advise me as to the most suitable materials for case-hardening ?

W.G. (Broadgreen, Liverpool.)

All kinds of mild-steel will case-harden fairly well, though some grades are more prone to distortion than others. For open hearth case-hardening, the preparations known as "Kasenit" and "Antol," can be recommended, and the instructions for the use of these are given on the container.

The general method of using such case-hardening compounds is by heating the metal to red heat, and rolling it in the case-hardening compound or sprinkling the latter on it. The metal is then reheated, and the process is repeated two or three times, according to the depth of hardening required, after which it is finally heated to a uniform red heat, and quenched out quickly in water.

Other case-hardening compounds may require the use of an enclosed box or flask in which the articles are packed together with the compound and sealed up air tight. They are then heated for a length of time, depending on the depth of hardening required. This method is preferable for deep case-hardening, such as when the surface of the materials must be finished by grinding after hardening.

Spiral Springs

I wish to make a number of spiral springs using 17-s.w.g. wire. Would you please tell me :—

(1) *To what temperature I should raise the springs before quenching, and how long should they be at that temperature before being quenched ?*

(2) *What should I quench them in ?*

(3) *Where can I buy 200 ft. of such wire ?*

T.W. (Hoo, Kent.)

We suggest that you might find it possible to make these springs from pre-tempered wire, such as piano wire, which would not require any subsequent treatment. This method is commonly employed by spring manufacturers, but a great deal depends on the duty for which they are required.

(1) In cases where heat treatment of the springs is required after forming, it will depend on the actual material from which the spring is made, but for carbon spring steel, the springs should be heated to 700-deg.-750 deg. Centigrade or 1,300 deg.-1,400 deg. Fahrenheit. No prolonged period of high temperature is necessary, and it is, in fact, undesirable, but even temperature throughout the entire batch of springs is essential.

(2) The springs should be quenched out in water. It is then necessary to temper the springs by reheating to a temperature of about 280 deg. Centigrade or 550 deg. Fahrenheit.

(3) We regret that we cannot advise you at present where wire of a suitable material for making springs can be obtained, but we suggest that you might enquire of Messrs. P. Ormiston & Sons Ltd., 31a, Denmark Road, London, W.13, who specialise in the supply of all kinds of wire.

Electric Fire

I am building an electric fire, and would like to know how to obtain the effect of burning coals.

A.S. (Glasgow, S.W.1.)

There have been several methods used to produce the effect of glowing coals, and one of the simplest is to use a small windmill on a vertical shaft, arranged in such a position as to encounter an upward draught of air from the heating element, and turning slowly, while the fire is in use.

From the rim of this windmill a coloured transparent screen is suspended in such a way as to produce shifting tints and shadows on a semi-transparent front screen, designed to imitate the appearance of live coals.

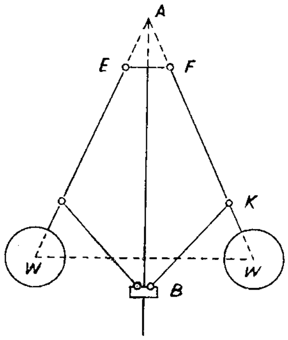
Governors and Governing

I have a small vertical steam engine, $2\frac{1}{4}$ in. bore $\times$ $2\frac{1}{4}$ in. stroke, to which I should like to fit governors.

Please could you give me some information regarding the principles of governing ?

M.H.C. (Smethwick.)

The usual type of governor comprises a shaft which carries two or more rotating weights on a system of links, which allows the weights to move outwards under the influence of centrifugal force.



In our sketch, the weights *WW.* are suspended on arms from pivots *E* and *F*. Two links pivoted to the arms at *J* and *K*, are connected to a collar *B*. As the weights move outwards, the collar *B* is lifted, and by means of suitable linkage is connected to the throttle-valve of the engine so as to close it down when the speed becomes excessive.

More detailed information on the subject, can be obtained from any good text book on steam engines or principles of mechanism.

Casting for Camera Body

I propose to construct a miniature camera, and wish to cast the body in light alloy. Will you please suggest a suitable type of alloy for this purpose, and also a suitable method of producing the casting.

K.W. (Bradford).

Any of the commercial aluminium alloys employed for general engineering work could be used for a camera body, but it would be desirable to use one which is fairly easy to cast, and also machines well. The alloy known as DTD 424, which is produced by most foundries nowadays, would be suitable.

We have published several articles on home foundry work in THE MODEL ENGINEER, and would refer you to the series on "Amateur Foundry Work" by A. L. Headech, published in the issues of May 25th, June 8th and 15th, 1950.